JPRS: 2684

23 May 1960

SELECTED ECONOMIC TRANSLATIONS
ON EASTERN EUROPE

(174th in the series)

Photocopies of this report may be purchased from:
PHOTODUPLICATION SERVICE
LIBRARY OF CONGRESS
WASHINGTON 25, D.C.

U.S. JOINT PUBLICATIONS RESEARCH SERVICE
205 EAST 42nd STREET, SUITE 300
NEW YORK 17, N. Y.

JPRS: 2684

CSO: 2000-N/174

SELECTED ECONOMIC TRANSLATIONS ON EASTERN EUROPE

INTRODUCTION

This is a serial publication containing selected translations on all categories of economic subjects and on geography. This report contains translations on subjects listed in the table of contents below. The translations are arranged alphabetically by country.

TABLE OF CONTENTS

POLAND

Data on Electric Power Plants in Lower Silesia

[This is a translation of an article by Tadeusz Kalinowski in Przeglad Mechaniczny, Vol XVIII, No 22, 25 November 1959, Warsaw, pages 719-722; CSO: 3557-N/1]

The Lower Silesia Power District includes almost all of Wroclar Wojewodztwo, the southern powiats of Zielona Gora Wojewodztwo, and Brzesc Powiat in Opole Wojenodztwo. This area was already well electrified before the war; its first electrical plants and networks were built during the last decade of the nineteenth century.

The Second World War, however, exerted a clearly negative influence on the Lower Silesian power facilities, since the devastations due to hostilities, as well as the plunder of the power installations during the war period, considerably reduced the productivity and the power transmission capacity of the equipment. Moreover, a part of the equipment suitable for operation or repair had to be returned to the countries from which it had been plundered by the Hitler regime. Thus, of the 380 meganatts of power installed in electric power plants on 1 June 1945--i.e., the day these territories were taken over by the Polish authorities--only 90 megawatts were suitable for operation. The devastation of electric power networks was estimated at 40 percent for high-voltage and 60 percent for low-voltage networks.

The ruins and rubble were gradually cleared: first the Wroclaw, Kalawsk, Glogow Electric Power Plants and then a number of minor hydroelectric plants were reconstructed. Thousands of kilometers of electrical network lines and hundreds of transformer substations were reconstructed. Finally the 110-kilovolt system network was reconstructed and expanded.

According to available German records, the power demand in the Lower Silesian area for 1960-1965 was supposed to amount to about 1900 x 10^6 kilowatthours, with a power output of about 500 megawatts (according to "Gutachten ueber die Elertrizitaets Versorgung von Schlesien," Munich, 1940). In

spite of the tremendous war gap, which the German authors could not foresee, the above quoted value will be achieved by this year.

Thus, the rate of the economic development of the above wojewodztwo is considerably higher than during the interwar period, while the power output and demand already considerably exceed the values they attained during wartime expansion.

A description of the power facilities, including prospects for their expansion, follows.

The Wroclaw Electrical Power Plant is by tradition the oldest in Poland, since its origin can be traced back to 1891. Originally built in the center of the city, this power plant was later transferred to a more convenient location. It was expanded and reconstructed several times. At present it includes:

- Eight boilers of 14 atmospheres pressure and 350 degrees centigrade temperature
- Three boilers of 35 atmosphers and 425 degrees centigrade
- A new boiler of 42 atmosphers, 425 degrees centigrade, and a capacity of 64 tons per hour, which was installed in 1957.

Altogether, the electric power plant has 12 boilers of a total capacity of 335 tons per hour. Seven of the newer models were modernized in succession during 1950-1958. The modernization consisted, among other things of the installation of mobile grates with forced draft, which reduces overfilling and assures better burning of the pulverized coal. Furthermore, the firing chambers were expanded and artificial draft fans installed. All these jobs were carried out according to domestic plans and with materials of domestic production.

The effects achieved through modernization are expressed by an increase in the boiler capacities of 66 tons per hour, improvement of the efficiency by an average of 18 percent, as well as a considerable inprovement of the operating reliability. At present, boiler breakdowns at the Wroclaw Power Plant are rarities.

Of the other achievements of the plant, the modernization of slag removal based on the application of basalt lining in

the slag removal piping system should be mentioned. The annual savings due to the above improvements--reduction in the consumtion of pipes and other materials--are estimated at about 30,000 zlotys. The replacement of the old German slag grinders with domestic ones (produced by ZUM in Pszczyno) has liquidated the bottleneck in the field of slag removal, since these grinders operate faultlessly.

A new feedwater pump house of 470 cubic meters per hour capacity, and a water softening house, icluding degasification equipment, wore also constructed.

The development prospects of the Wroclaw Electric Power Plant are closely connected with the city's heating planning. The convenient location of the plant, the possibility of easy and cheap conversion into a municipal electrical central heating plant, and the planning of large housing blocks in the center of Wroclaw create particularly favorable conditions for the generation of electricity at a central heating plant.

The Czechnicz Electric Power Plant, reconstructed in 1953-1955, is at present the most modern heating plant in Lower Silesia. The localization of this plant was decided by the fact that the estate left over from previous times in the form of buildings and facilities was of substantial material value. This did actually result in a reduction of construction costs, but on the other hand the builders and planners ran into difficulties entailed in the adaptation of the buildings and facilities as well as numerous ruins. At the end, however, they succeeded in utilizing the central grinding house, administration building, warehouses, and other outdoor facilities.

Because of its size, the boiler house had to be demolished and rebuilt a second time. Only the walls of the machine room were retained. The pump house was reconstructed. The grinding house also had to undergo costly and lbor-consuming changes.

Since its reconstruction, the Czechnicz Electric Power Plant has been equipped with:

Four boilers, pressure 80 atmosphers, temperature 500 degrees centigrade each, with a total capacity of 520 tons per hour;
Two turbine sets of a total output of 110 megawatts.

The equipment for the electric power plant was supplied by the Czechoslovak industry: the boilers by the I Brnenska Enterprise, the turbine sets by Skoda. All auxiliary facilities are also of Czech origin. Only the transformers were supplied by the Italian firm, L'Ansaldo San Giorgio.

The power plant operates in two blocks, each of which consists of two boilers, one turbine set, and one power transformer. The turbine sets are cooled b a closed system.

The planned net thermal efficiency of the power plant--25 percent--was not only attained in practical operation, but--in spite of many difficulties--was even exceeded by means of a number of minor improvements. At present the possibility of installing a third turbine set on the order of 30 megawatts is under consideration. This will make it possible to utilize the steam surplus in the boilers, as well as to adapt them for operation with liquid slag.

The Victoria Electric Power Plant is the largest in Lower Silesia. Completed in 1912, it was originally designed as an industrial power plant for a coal mine and later twice reconstructed (1920-1922 and 1936-1942). It produces, in addition to electric power, compressed air and heat for the consumers of the Victoria Combine.

In 1945 the above electric plant was equipped with:

Seven bent-tube boilers, 15 atmospheres, 350 degrees centigrade each, with a total capacity of 86 tons per hour
Four Benson boilers, 130 atmospheres, 485 degrees centigrade each; total capacity, 320 tons per hour
Five steam condensing turbine sets of a total output of 69.4 megawatts
Two frontal turbine sets, 120 atmospheres; total output, 36.0 megawatts
Two turbo-compressors of a capacity of 130,000 cubic meters per hour (steam pressure 15 atmospheres)
Three electric compressors of a capacity of 32,000 cubic meters per hour.

The total installed power in the electrical powerplant amounted to 105.4 megawatts.

During the past few years the stock of equipment underwent considerable changes. A new Pauker high-pressure boiler

with the following parameters was constructed: pressure 130 atmospheres, temperature 500 degrees centigrade, capacity 150 tons per hour. A new BBC 120/17 atmospheres, 18-megawatts frontal turbine set and a I Brenska of 60,000 cubic meters per hour turbo-compressor were insalled.

In order to assure the supply of feedwater to the expanded plant, a water source with a 6-kilometer pipe line was established in the nearby Czarny Bor locality.

Moreover, in connection with the necessity of abandoning the combustion of local coking-coal (in view of the deamnd for this fuel by the coal-tar chemical industry), the high-pressure boilers had to be adapted for firing Upper Silesian coal. This called for a partial reconstruction of the combustion (burner) chambers. The storing of coal also had to be assured. This problem was solved by the construction of a recessed bunker of 15,000 tons of useful capacity. A new 10-kilovolt power distribution system was installed and the existing 110-kilovolt distribution system was expanded by four new sections, in conjunction with the development of the electrical network. After the expansion, the installed power of the plant increased by 123.4 megawatts.

The compressors were also rearranged. The three small electrical compressors were transferred to the mines and replaced by a turbo-compressor with a capacity of 60,000 cubic meters per hour, which increased the [compressed] air production possibilities up to 900,000 cubic meters per hour.

In view of the difficult local conditions, such as scarcity of space and inadequate water supply, no further expansion of the plant is foreseen. The remaining central heating-industrial plants--i.e., Walbrzych, Skaleczno, Ludwikowo, Legnica, and Glogow--are all obsolete and uneconomical. They have a total of:

26 low-pressure boilers of a 360 tons per hour capacity
13 turbine sets of 64.6 megawatt capacity.

The above electric power plants lose their importance as supply sources of local consumers as the high-voltage electrical networks expand. At present they handle exclusively additional loads during peak periods and retain the function of reserve plants at other times.

Their operation is expected to be limited even more in the future. With the exception of the Walbrzych Plant, which will remain in the winter reserve, all other plants are expected to be completely withdrawn from service by 1965.

The hydro-electric power stations constitute quite an essential element in the Lower Silesia Power District. They are characterized by a small amount of installed power. The ZEOD [Power Association of the Lower Silesian District] includes 42 electric power plants of 49.4 megawatt capacity handled by 86 turbine sets; thus the average capcity per turbine set does not exceed 600 kilowatts. The average age of a turbine set is 39 years. Moreover, it should be added that the 11 major plants (of capacity above one megawatt) supply three fourths of the total hydroelectric power station capacity. Thus in Lower Silesia the hydroelectric power plant type, which we classify as so-called "minor power engineering," is predominant.

This is closely connected with the historical development of power engineering on these territories. Most of these plants were built during a period when the electrical networks were still in their initial stage of development and a number of industrial enterprises, mills, or community centers sought ways to utilize local water resources for power supply purposes, which 50 years ago could entirely solve any power supply problems.

The terrain conditions in Lower Silesia are such that the mountain type electric power plant (steep slope, moderate flow) as well as the lowland type are well represented. This circumstance, as well as the lack of coordination in the development of water power engineering, resulted in another characteristic phenomenon--namely, agreat diversity of turbine types. All this considerably complicates the operation and reflects unfavorably upon the production costs of power in hydroelectric power stations, the minor ones of which cannot enter into "competition" with the large modern steam power plants.

During the past few years a tremendous effort was made to reconstruct and modernize the hydroelectric power plants. Of the more important projects, the construction of 16 dams and the complete reconstruction of the foundation of the Olszno Electric Power Plant should be mentioned. The work on the four Nisa Lozycka electric power plants still continues. The operation of 16 power plants was mechanized, thus increa-

sing their operative reliability and considerably reducing their production costs. The largest investment, however, went for the construction of a new electric power plant, including a navigable water lock, at Waly on the Odra. The four turbine sets, of a total capcity of 8.1 megawatts, as well as all auxiliary equipment were supplied by the Czechoslovak industry. The plant was domestically designed.

The broad prospects for the water power economy in the Lower Silesian District are rather favorable. The program outlined for the near future calls for further automation of the minor plants and the grandual replacement of worn out water turbines, with the aim of reducing the number of types to a minimum. The expediency and possibility of constructing a number of large--considering the Polish hydrographic conditions--electrical water works for the handling of peak loads, is considered within the framework of future power engineering projects.

The Turow Electric Power Plant is the largest power engineering undertaking in Poland. The problems connected with the construction of that plant are generally well known. Therefore, I shall limit my outline to a summary of the main plans of that plant.

The dynamic growth of the demand for electric power in Poland exceeds the possibilities of expanding pitcoal mines, which are still the basic power resources in our country. Therefore, the necessity of finding other power resources has been actual for several years now. The then available data regarding brown coal deposits, supplemented by further explorations, have shown that we are in possession of substantial deposits of brown coal suitable for exploitation. In certain locations these deposits are so shallow that the coal can be extracted by the open pit method. The first deposit of this kind was first handed over for exploitation after the war in the Konin area.

Turoszow was the second place assigned for open pit exploitation. An open mine, supplying the existing German Hirschfeldo Electric Power Plant, has been in operation there for a number of years. This mine also partially supplies the industrial Kalawsk Electric Power Plant. Thorough investigations indicated that the resources of these deposits amount to about one billion tons. Its fuel value ranges from 1,500 to 2,800 kilocalories per kilogram. The above deposit guarantees fuel supplies to an electric plant having a capa-

city on the order of 1,200 megawatts during an operating period extending to the depreciation of the equipment, even if one considers 7,000 hours high for the annual power utilization time.

After a number of places earlier designated for eventual construction sites had been surveyed, Turoszow was picked as the most favorable in view of its immediate proximity to a mine. This offered the possibility of reducing transportation costs. The greatest problem--lack of sufficient amounts of cooling water--was to be solved by the construction of a cooling tower, since the medium flow on the Nysa Luzycka River and its tributaries, the Witka and Miedzianka, do not guarantee an adequate cooling level.

It was decided to build the elctric power plant in one stage--i.e., without interruptions--whereby its capacity was set at 1,200 megawatts, making it one of the largest in Europe. In connection with this the necessity arose of using plant units of dimensions still rarely applied in the world.

The domestic power industry is not equipped for the production of machinery of this size. It was therefore, necessary to rely on foreign suppliers. Finally, it was decided to select KSG boilers (West Germany) of 650 tons per hour capacity and 160 atmospheres, 540/54 degrees centigrade steam parameters and LMZ turbine sets (USSR) of the PWK-200 type with steam parameters of 130 atmospheres, 535/535 degrees centigrade. The voltage of the generators is 15.75 kilovolts.

The following data reflect the magnitude of that undertaking.

[1] The volume of the main building will be 780,000 cubic meters; its construction will consume 12,000 tons of steel.

[2] The annual output of the electric power plant after it is fully expanded will be 8 billion kilowatthours--i.e., more than twice as much as the annual production of all the electric power plants in pre-1939 Poland.

Beside commercial electrical power plants, an important position in the power engineering balance of the Lower Silesian District is occupied by the industrial electric power

plants. The latter, 125 in number, may be divided into two groupts according to their efficiency.

To the first group belong the uneconomical plants, the majority of which were constructed before 1914 and mostly equipped with fire-tube boilers and steam condensing machines. The highly depreciated equipment, as well as the high coal consumption per kilowatt-hour (sometimes reaching 3 kilograms of coal), compelled the management of these plants to liquidate or reconstruct them.

To the second group belong the more recently built or completely new electric power plants, equipped with back-pressure and condensing turbine sets. They were installed in plants where the consumption of thermal energy is high, guaranteeing efficient operation of a heating system in the complex economy.

Electric power plants at sugar plants, which operate only periodically, also belong to the second group.

Some of the power plants belonging to the second group, such as those at the Jelenia Gora and Wroclaw Synthetic Textile Plants [Zaklady Przemyslu Wlokien Sztucznych] or the "Rokita" Chemical Plant in Lower Brzeg, were constructed after the war.

The total installed power of the industrial electric power plants whose capacity exceeds 0.5 megawatts--amounts at present to 135.1 megawatts.

The electric power produced in the Lower Silesian District does not meet the growing needs of its consumers; therefore, certain amounts of power are imported from other districts and from abroad. Not until the Turow Electric Power Plant is in operation will Lower Silesia become an exporter of electric power on a large scale.

* * *

In conclusion, a few more words about the development of industrial facilities in the Lower Silesian District.

Before 1945 the power system of Lower Silesia did not constitute a closed unit but was connected by a 110-kilovolt

network with neighboring areas to the west and east, and it also cooperated with electrical power plants in Czechoslovakia. The devastations due to the war interrupted these connections. Several years later, cooperation with Czechoslovakia as well as with the Germans was restored.

Since 1949, connections have been established with the Poznan District through the Dychow Electric Power plant, as well as with the Upper Silesian District through Groszowide, thus connecting the Lower Silesian network to the nationwide power system. The fundamentals for that system were established only after the war. A dispatcher service was organized even before the system was established. The task of this service is to regulate the load level in the individual electric power plants, according to the actual demand and in accordance with the economical distribution of loads. Such a service did not exist in the Lower Silesian District before 1945.

The 110-kilovolt system network will be considerably expanded during the coming five-year period. For the first time the voltage of 220-kilovolts will be introduced into Lower Silesia, and this will considerably intensify the connections with the nationwide system and will permit the introduction of power from the Turow Electric Power Plant. In time the 110-kilovolt network will aquire local importance. Even now certain sections of this network in our district, such as Czechnicz-Rokita, function as local supply lines.

In addition to the 110-kilovolt network, 15,000 kilometers of medium- and low-voltage networks have been constructed or reconstructed during the past 14 years.

At present the Lower Silesian District has a power network of a total length of 30,000 kilometers, of which 13,000 kilometers are of high voltage and 17,000 kilometers are of low voltage.

The coming Five-Year Plant will also bring great changes to nearly all cities of Wroclaw Wojewodztwo in the field of street lighting. Important projects will be carried out in order to modernize and increase the level of illumination. One of the main guiding concepts in this field is the use of more economical fluorescent lighting. Cooperation with the electrical industry, as well as the production of certain elements should reduce the material difficulties which still

hamper the progress of the work. In spite of these difficulties, over 3,500 new lighting outlets were installed during the past two years.

This article does not exhaust the problem. Lack of space obliged me to limit myself to presenting only the problems which are of interest to the Przeglad Mechaniczny reader. Therefore, the purely electrical problems were treated particularly superficially.

Photo Captions

Figure 1. Ball Mill at the Czechnicz Electric Power Plant

1219

POLAND

"Pafawag" Railroad Car Factory in Wroclaw

[This is a translation of an article by Engr Ludwik Kuberski in Przeglad Mechaniczny, Vol XVIII, No 22, 25 November 1959, Warsaw, pages 723-725; CSO: 3667-N/2]

The Railroad Car Factory in Wroclaw is one of the largest factories manufacturing rolling stock in Europe.

The freight and passenger cars, locomotive tenders, railroad flatcars, electric locomotives, and three-section electrical passenger trains manufactured in this factory not only serve the Polsih State Railroads but are also exported to numerous European countries and to India.

The history of this enterprise, its reconstruction, development of production, and mastery of advanced techniques; the history connected with the plant and its personnel, aware of their aims, can be traced back to June 1945, when the first workers entered the Linke-Hofmann Werke A.G., heavily devastated during the hostilities.

The entire power installation, including the transformer substations, boiler rooms, and production halls, were destroyed. The machinery and technical equipment were destroyed or removed deep into Germany. The office facilities and most of the material reserves were also destroyed. The destruction of factory building was estimated at about 30 percent, that of machinery, equipment, and technical facilities at about 80 percent.

In developing the economy and reconstructing the country one of the first requirements was rolling stock. The shortage of rolling stock was deepened by the destruction of the Ostrowieg Factory in Lilpop Rau and the Loewenstein Factory in Warsaw and the Zieleniecki Factory in Sanok, amounting to a total production capacity of 6,300 freight cars and 180 passenger cars per annum. Under such circumstances, the "Pafawag" personnel were confronted with the extremely important task of rapidly restoring the production of rolling stock as well as the reconstructing and modernizing of the enterprise.

The reconstruction of the plant was begun in the middle of 1945 by the removal from the premises of 2,000 carloads of rubble and 640 carloads of iron scrap. Over a billion cubic meters of buildings of a total area of about 15 hectares were restored, and a surface equalling 10.52 hectares were glazed. Six thousand cubic meters of new buildings were constructed and several kilometers of railway tracks were built. Furthermore, over 600 machines and pieces of equipment (new ones or those restored and obtained through war reparations) were installed.

At the same time, new personnel was engaged and trained. Following an appeal by the government, people from all over the country and re-emigrants from France, Italy, Canada, Belgium, and England as well as people returning from concentration, prisoner-of-war, and forced labor camps began to flow into Wroclaw. During the initial period, the arrivals had to be provided with food and shelter. People who had never before been engaged in industrial work had to be taught a new profession. A dining area which could seat about 1,000 people was organized; 945 housing units, which formed a housing colony for the personnel in the Grabiszynek, M. Muchobor, and Nowy Dwor quarters, were taken over and renovated. As early as the fall of 1945, an advanced technical school, which was attended by 400 students, was opened at the plant. A professional training center for older personnel, which was attended by over 800 students, was also organized at the plant. Courses for welders, turners, locksmiths, etc. were organized. A basic vocational school was opened. Owing to this organized action, illiteracy was wiped out within a few years, and those who had no previous professional training were taught a profession.

The rapid delivery of railroad cars was a problem of primary importance. Therefore, the production of coal freight cars was launched as early as in 1945, and by the end of that same year 50 of them were ready for use.

In 1946 the factory produced 2,700 coal freight cars and three passenger cars and repaired 28 passenger cars. In 1949 that factory produced 9,531 coal freight cars, 74 locomotive tenders, 72 flat railway cars, and 65 mail cars. In the same year, 355 passenger cars were subjected to a total overhaul and 20 special cars for the transportation of steel (ordered by Holland) were constructed, thus raising the production level above that attained in the factory by the Linke-Hofmann Werke firm.

The basic technical problems which arose during 1945-1949 were reconstruction and modernization of the machine stock, tooling of the production--especially the production of coal freight cars, and the adaptation of welding construction methods. In connection with this, the factory proceeded with the training of welders and the development of high-efficiency welding methods. At the same time a welding drum on which eight coal freight car axles could be welded simultaneously was installed. Multielectrode welding, so-called "cluster welding," as well as ultra-short arc welding were applied. The high-quality construction of the welded cars was confirmed by tests. Two types of coal freight cars were developed and launched into production.

During the following years the number of assortments produced was consistently increased and more and more advanced rolling stock units were launched into production. In 1953 the factory produced a prototype of an electric locomotive, made in cooperation with a foreign supplier of electrical and electropneumatic apparatuses, and in 1954 a prototype and the first series of electrical passenger three-section cars. The following electrical units were manufactured during that period:

Type BO BO IE electric locomotive: four-axle, weight [empty] 80 tons, designed for passenger trains, capacity 1,500 kilowatts, speed 110 kilometers per hour, powered by direct current at 3,000 volts;

Type CO CO electric locomotive: six axles, weight 120 tons, designed for freight trains, capacity 1,500 kilowatts, speed 60 kilometers per hour, powered by direct current at 3,000 volts.

The above train type weighed 127 tons and could carry 200 passengers (seats).

The first electric locomotive and first electric three-section train based on cooperation with the M-5 Electric Machine Factory in Wroclaw and other electric machine and equipment plants were produced in 1957. The complete mastery of the production of electric locomotives should be regarded as a great achievement of not only our designers and technologists but of the entire "Parafag" personnel, as well as the cooperating electric machine and apparatus factories, and in particular the M-5 plant in Wroclaw.

Electric traction units produced for the first time in the history of the Polish industry are:

[1] Type Co Co 3E electric locomotive: six-axles, weight 120 tons, designed for passenger and freight traffic, capacity 2,400 kilowatts, speed 92 kilometers per hour, powered by direct current at 3,000 volts.

[2] Type 3B-4B electric three-section train: capacity 740 kilowatts, speed 110 kilometers per hour, powered by direct current at 3,000 volts, weight 123 tons (200 seats).

In connection with the large-scale electrification plan for the Polish State Railroads, planned by the government, the development of the production of electric traction units in our enterprise is of great significance for the entire national economy.

The Seven-Year Plan (1958-1965) entrusts "Parafag" with the task of producing, during that period, 290 electric locomotives, 300 three-section electric trains, 900 various types of passenger cars, 47,000 various type freight cars. Of this 23,000 steel coal freight cars.

At present the factory produces a wide assortment of various types of rolling stock units--namely, narrow-gauge passenger cars for export to the USSR (Figure 1); standard-gauge passenger cars, 26 meters long for export to Yugoslavia; first and second class sleeping cars for the "Orbis" PBP [Polish Travel Bureau] (Figure 2); Type 3E electric locomotives (Figure 3); Type 3B-4B electric three-section passenger trains (Figure 4); covered freight cars of 23.5-ton capacity (Figure 5) designed for export to Hungary and Yugoslavia, as well as to satisfy the demands of the Polish State Railroads.

"Parawag" made considerable progress in the production of rolling stock, especially in raising the quality of its products, the aesthetic appearance and comfort of the car interiors, and in improving their value. Panels made of scarce wood are being replaced more and more by fibreboard panels. Synthetic products are finding wider and wider application in car upholstery. Our production not only meets the domestic demands but has a significant share in the export of Polish industrial machinery. During the past few years we have been exporting freight cars, tenders, and passenger cars to the Soviet Union; various types of freight

cars to Czechoslovakia, Hungary, Bulgaria, Yugoslavia, Holland, and India; passenger cars and chassis for passenger cars to Yugoslavia and India. "Pafawag" made rolling stock units have now great recognition among foreign buyers. In our enterprise the quantity as well as the quality of the production has increased; the same applies to the level of efficiency and work organization.

The "Pafarwag" personnel, hardened by reconstruction work and daily production, appreciates its gains of the 15 years of People's Poland with a feeling of fulfilled duty.

Photo Captions

Figure 1. Narrow-gauge Passenger Car (for Export to the USSR)

Figure 2. Sleeping Car Designed for "Orbis" PBP

Figure 3. Type 3E Electric Locomotive

Figure 4. Type 3B-4B Three-section Electric Passenger Train

Figure 5. Covered Freight Car of 23.5 Ton Capacity

1291

POLAND

Mechanical Equipment Plant in Wroclaw

[This is a translation of an article by Engr Jan Janiszowski in Przeglad Mechaniczny, Vol XVIII, No 22, 25 November 1959, Warsaw, pages 725-727; CSO: 3657-N/3]

The hostilities, which did so much damage to Wroclaw, did not spare the area now occupied by the Wroclaw Equipment Plant. During the German occupation, nine plants of diversified production and of industrial and economic importance were located in the area.

The destruction of the buildings and technical facilities, electrical installations, water supply and sewer systems, and gas and central heating systems reached 70 to 75 percent. The obsolete and destroyed machines were of no use, while other technical facilities (for example, hoisting equipment) required thorough depair. The remaining facilitieis gave evidence of the rather low technical level of those plants, and the administrative buildings were temporary ones. The plants employed an estimated 800 people.

Under such conditions, without shelter, the Machinery Conveying and Repair Base (Baza Zwozki I Remontu Maszyn), which operated until 1947, began its operations. In 1946 the Machine Tool Repair Plant (Zaklad Remontu Obrabiarek), was established which, toward the end of that same year, became the Wroclaw Machine Tool Plant.

The reconstruction of the plant began in 1946 with the restoration of the present machining hall of 4,820 square meters and the construction of a barracks containing social facilities. Soon after, in 1947, followed the reconstruction of a hall designated as a main warehouse as well as tool room, of a total area of about 2,800 square meters, and in 1948 the administration building was rebuilt.

The restoration of the present light-duty machining hall (area 3,100 square meters) was completed during the first stage of reconstruction in 1949. At that time this hall contained the assembly department. The largest hall, which at

present contains the assembly department (area 5,300 square meters), was restored as late as in 1953; the new boiler room was constructed at the same time. Simultaneously with the reconstruction of the buildings, the electric power installation, high voltage substation, distribution equipment, and other electrical facilities were entirely modified. A central telephone office was established and a telephone system installed. Also at the same time, a steam-air heating system was installed, and hot water was introduced into the wash room. A medical and dental dispensary were established for the use of the personnel. The restored projects ensure safety and hygiene in work.

Most of the roads were constructed, the warehouse restored, and many reconstructions carried out with the purpose of permitting better development of production and utilization of the building areas.

As soon as the plant was converted into the Wroclaw Machine Tool Plant, preparations were made for the production of metal [cutting] machine tools and the first type Pr-300 frame saws (Figure 1) appeared as early as 1947. The production of saws as well as the following series of machine tool types were based on documentation supplied by the Central Machine Tool Designing Office in Pruszkow (Centralne Biuro Konstruckyjne Obrabiarek).

In 1948, besides the serial production of the above frame saws, the production of Type SP-600 and SP-800 horizontal shapers and type WK-63a vertical drilling machines was launched. This assortment fulfilled the production plan for the year 1949. In 1950-1952 the production plan comprised, in addition to the above types, type SP-400 horizontal shapers, type WK-63b and WK-63c vertical drilling machines, type WKW multi-spindle drilling machines, type WE-20 pedestal drilling machines, as well as machine chucks and tool posts.

The plant adopted its present name of Wroclaw Mechanical Equipment Plant in 1951. The WFUM [Wroclaw Mechanical Equipment Plant] began its production of lathes in 1953. The first to appear were type 3 TPX and type TPS-400 lathes with 1,000-millimeter bed lenghts. In 1954 and 1955 the plant switched to the exclusive production of lathes, expanding their assortment by the type TPS-400 lathe with 750-k,500,- and 2,000-millimeter bed lengths, and type TNS-400 with 750- and 1,000-millimeter bed lengths.

The prototype of the type TPC-40 x 750 (swing diameter 400 millimeters) high-speed production lathe, produced in 1954, initiated the production of type TC lathes, which the following year went into production as type TPC-40 lathes of 1,000-, 1,500-, and 2,000-millimeter bed lengths, as well as type TUC-40 universal lathes of bed lengths mentioned above.

The production of the following two years consisted exclusively of type TPC-40 and TUC-40, as well as type TUC-50 universal lathes with bed lengths of 750,1,000, 1,500, and 2,000 millimeters, but with increased distances between centers (swing diameter 500 millimeters).

As already mentioned above the production of all the lathe types was based on documentation supplied by the Central Machine Tool Designing Office however, the Plant Designing Office also began its activities with the purpose of modernizing and improving the production of lathes. In this way, a reducer with automatic preselection was designed, which has been in use since 1956; a variant of type TC lathe known as TUC-50 and a modern feed box with screen and expanded feed range for the universal lathe were created.

As a result of tests and experiments, type TKB-12 hydraulic reproducer [for copying models] was designed. This reproducer is now being manufactured as a special feature of the type TC lathe.

The production assortment of the plant was expanded (in 1958) through the launching into production of the heavy-duty type TGA-18 copying lathe and the side production of a small series of type TUA-25 lathes.

Passing in turn to the description of recently produced lathes, let us discuss the type TC high-speed lathes first. To this category belongs the type TUC-50 universal lathe with type TKB-12 hydraulic reproducer (Figure 2). This group includes type TPC-40 production lathes as well as types TUC-40 and TUC-50 universal lathes with bed lengths of 750 to 2,000 millimeters. The rigid structure of all components--and especially that of the box-type bed and the drive power as well as the wide speed range of the spindle and feeds qualify the lathe for the machining of any material under the most difficult conditions.

The type TKB-12 hydraulic reproduced permits traverse copying according to a round pattern on all types of TC lathes, while type TUC-50 lathes permit traverse copying according to theflat pattern as well. The copies can be carried out with precision to 0.01 millimeters with respect to the dimensions of the model.

The heavy-duty type TGA-18 copying lathe (Figure 3), presently manufactured by the WFUM, constitutes a different type of lathe.

The lathe is of entirely unconventional design. The bed of the lathe consists of a strongly ribbed beam resting on a box-like base, which houses in its left part the main drive motor and the electrical devices, in the right part the hydraulic equipment, and in the center the refrigerant container. The carriage and tailstock slide along the bed slide bars, which are inclined in relation to the vertical at an angle of 15 degrees, so that the carriage presses on the slide bars by its own weight. The carriage consists of two parts: the lower, which slides along the bed with the aid of a lead screw, and the upper, moved hydraulically along the slide bars inclined at 60 degrees. The hydraulic copying device is mounted on the carriage.

The type TGA-18 lathe is basically designed for the machine with fused carbide tools of round objects of 40 to 180 millimeters diameter and up to 1,000 millimeters long.

Besides the turning of irregularly shaped objects, the turning of irregular shafts is also possible.

To simplify operation, the lathe has a partly mechanized operating cycle consisting of the following steps: operating advance to the left; stop; removal of cutting tool from material; rapid return to the right; approach of cutting tool to the material; stop; etc. The lathe is provided with a special pneumatic holder.

The number of standardized lathe types considerably increased in 1955.

Owing to their present quality, the lathes appearing under the "Wafum" trademark play a more and more significant role in Polish exports. The export production, which in 1955 comprised 2.1 percent of the annual production of the plant, increased in 1958 to 5.2 percent and indicates a consistent upward trend.

TC lathes, when demonstrated at international fairs or exhibitions, always arouse great interest and have important buyers.

WFUM customers can be found among industrial plants in socialist countries as well as capitalist countries. Their total number is 26: Albania, Austria, Australia, Brazil, Bulgaria, China, Czechoslovakia, Denmark, Egypt, Finland, France, Holland, Israel, Yugoslavia, Korea, Morocco, East Germany, West Germany, Rumania, Sweden, Tunisia, Turkey, the USA, Hungary, Vietnam, and Italy. The most important customer is the "Fiat" firm.

The undertaking of the production of machine tools, followed by the transition to an assortment of machines requiring higher precision in production, was possible only because the plant was equipped with modern machine tools and facilities. The expanded hardening shop permits adequate treatment by means of gas carbonization as well as by the consistently wider applied induction hardening. The mechanization and automation of technological processes continues to make progress.

Various machining devices and other equipment, which make it possible to save labor and to considerably improve the quality of the products, are being designed and manufactured.

The plans of technical advance call for an expanded range of machine tool aggregates, further mechanization of auxiliary operations, and modernization of technological processes.

The qualifications of the personnel are being raised at all levels. Many employees have finished the engineering evening school or technical school with favorable results. A number of workers continue to attend the evening technical school, evening engineering school, or study elsewhere. The master and apprentice courses conducted at the plant are very popular. Raising the qualifications of the personnel results in a higher level of technological planning and initiates a rationalization movement which brings great advantages.

The results of competition among various plants of the machine tool industry--in which the WFUM occupies, in most cases, a leading position, and in 1958 during three subse-

quent quarters occupied the first place--give evidence of the level and achievements of the personnel.

The production results of the first half of 1959 which indicate that the production plan was carried out 102.3 percent with a 3-percent reduction in labor, assure us that in the current year there will be further progress in the development of the enterprise.

The above design work and careful study of the produced lathes are aimed toward the development of an advanced universal lathe of increased capacity, expanded speed and feed ranges, and rapid horizontal feed. This lathe will be manufactured in two models, for maximum swing diameters of 400 and 500 millimeters and bed lengths of 750 to 2,000 millimeters. Their simplicity of operation and advantageous features were favorably evaluated by the Lathe Evaluation Commission. A prototype is expected to be produced during the first half of next year.

Future prospects include the designing of a similar lathe of 630-millimeter swing diameter and the redesigning of the type TGA-18 copying lathe.

The Wroclaw Mechanical Equipment Plant has good development prospects. The further expansion of the plant during 1959-1965 includes such projects as the restoration of the repair shop; minor additional construction with the purpose of increasing the production area of the light-duty machining and assembly departments; expansion of the heavy-duty machining department; construction of a prototype shp, casting storage, and cleaning loom; and the construction of a social building, house of culture, and facilities for other services. With a relatively small expansion of the plant and minimum increase of the personnel up to 1965, the production is expected to double, and the production assortment will be entirely revised and expanded.

The expansion of the plant included the construction of a Home for the Young Worker, which provides living quarters and cultural conditions for about 200 single workers. This year, a housing cooperative consisting of 60 members was founded near the plant. A settlement for 1,200 inhabitants is also planned near the plant.

It should be added that--the WFUM was specified by the Minister of Heavy Industry as the only plant in the machine

tool industry to be entrusted with the preparation of engineering standards for introduction into that branch of industry. The ambitious personnel of the Wroclaw Mechanical Equipment plant view the drawn up plans and intentions as entirely realistic.

Photo Captions

Figure 1 Assembly of type Pr-300 framesaws

Figure 2 Type TUC-50 universal lathe with type TKB-12 hydraulic reproducer

Figure 3 Type TGA-18 copying lathe.

1291

POLAND

Wroclaw Metallurgical Plant

[This is a translation of an article by Engr Jan Mikolajczyk in Przeglad Mechaniczny, Vol XVIII, No 22, 25 November 1959, Warsaw, pages 731-732 CSO: 3667-N/4]

This plant was taken over from a private owner in December 1945 and named initially "Iron and Metal Foundry" and later "Karlowice Foundry." The plant was partly destroyed during the hostilities. The iron foundry constituted the sole production department. A second production department was established in the second half of 1946--the foundry for nonferrous metals.

In the meantime a warehouse for finished products, a boiler house, a railway siding, a metal cutting department, a tool room, and a laboratory were built, all of which made the plant an enterprise prepared to manufacture machines and equipment.

In 1955 the plant was taken over by the Central Administration of the Agricultural Machine Industry, which developed a program for the production of type RSS-6, OK powered root cutters as well as spare parts for various agricultural machines.

The type RSS-6, KO root cutter is hardly applicable to medium size farms; therefore, it was necessary to produce another root cutter. The Plant Designing Office then developed the type SU-1, O universal root cutter (Figure 1).

Since there was a shortage of circular saws on the market, their production was undertaken on the basis of the plant's own specifications. The plant designing office developed the type PT-1 circular saw (Figure 2).

The plant had no established specialization trend up to 1957, and only in 1958 was it decided to adapt it to the production of equipment and devices used in the fight against harmful insects as well as for soil irrigation.

The first device of this kind, now in production, is the type OP-20 (Figure 3) portable sprayer developed according to specifications of the Institute of Agricultural Machines (Institute Maszyn Rolniczych). It is intended for use in gardening, cultivation of orchards, planting, or on any area where the use of a motor or horse sprayer is difficult or impossible. It can also be used for disinfecting and white washing interiors. The sprayer tank, made of brass sheet metal, is equipped with a return valve and manometer as well as safety valve. The liquid in the sprayer is ejected by air pressure created with the aid of a manual pump.

The spraying liquid is pumped into the tank with the aid of the same pump.

The plant also produces sprinklers for the irrigation of gardens, vegetable gardens, flower gardens, etc. One of the currently produced sprinklers is shown in Figure 4; this is the type ZO-1 rotary sprinkler.

Recently the type MOR-200 sprayer (Figure 5), designed to operate with the type C-308 single-axle "Ursus" tractor, was launched into production. Its design is simple and compact. All components which come into contact with the spraying liquid are made of brass.

The production assortment of the plant is steadily expanding. The production plan for 1960-1965 sets for the plant the important tasks of increasing the quantity of equipment and devices already manufactured, as well as of introducing into production new types of equipment.

Photo Captions

Figure 1. Type SU-1,0 universla root cutter

Figure 2. Type PT-1 circular saw

Figure 3. Type OP-20 portable sprayer

Figure 4. Type 20-1 rotary sprinkler

Figure 5. Type MOR-200 sprayer

1291

POLAND

Jelcza Motor Vehicle Plants

[This is a translation of an article by Engr Edward Dworzak in Przeglad Mechaniczny, Vol XVIII, No 2, 25 November 1959, Warsaw, pages 734-735; CSO: 3667-N/5]

The Jelcza Motor-Vehicle Plant is one of the largest enterprises in Lower Silesia. The plant was built during the last war for arms production purposes; it was partly destroyed as a rusIt of the hostilities.

During the first postwar years, the factory halls were utilized as warehouses for the Central Machinery Sales Office, the Wojewodztwo Chemical Industry Wholesale House in Wroclaw, the Nonferrous Metals Sales Center, and various repair and construction enterprises. The Jelcza Motor-Vehicle Plant, which later was divided into the Motor-Vehicle Chassis Construction Plant and Motor Vehicle Repair Plant, specializing in carrying out major automobile repairs, was established as late as 1952. During the first period the repairs comprised various mtotr-vehicle types. In time the repairs were limited to M-20 "Warsaw" passenger cars and "Star" trucks.

Parallel with the development of the Motor-Vehicle Repair Plant began the production of the Motor-Vehicle Chasis Construction Plant, limited to the construction of "Stonka" type buses on "Star" truck chassis, vans, as well as mobile repair shops for construction, forestry, and other purposes. The above production was carried out on a small scale.

After both plants were taken over by the Association of the Automotive Industry and consolicated under the name of Jelcza Motor-Vehicle Plant, the production profile of the plant became more apparent. Besides the above-mentioned chassis, in 1958 the plant launched the production of type SBA-2000/15 fire engines (Figure 1) with an N761 chassis designed by the Automotive Industry Designing Office in Warsaw, now being improved by the plant's designing office.

The type SBA-2000/16 fire engine has special features and is equipped with an A-1600 automatic pump of 1,600 liters per minute capacity, a 2,000-liter water tank, and two 100-liter tanks for foam-producing liquids. The provision of a water tank and a 3,000-liter tarpaulin reserve tank makes the motor vehicle useful for putting out fires in areas suffering from water shortage.

The type SBA-2000/16 fire engine is mounted on a special chassis whose design is based on elements of the Star 21 truck chassis. By expanding the wheel gauge (to 3,850 millimeters), good stability and better driving features were obtained. The chassis of the skeleton-type fire truck is made of pressed steel frames, connected by welding. From outside the chassis is covered by sheet metal 0.75 millimeters thick, whereas its interior is lined with fibreboard. The chassis consists of a cabin for driver and chief, accommodations for the firemen, a built-in tank, a housing for the autopump, and drawers for the equipment. The compartment for the firemen is heated by steam generated in the recuperator built into the exhaust pipe.

Besides normal lighting (Front lights, rear, and directional lights) the fire truck is equipped with an additional conflagration reflector, two call-out reflectors, and anti-fog reflector as well as interior lighting. An alarm siren is installed on the roof.

In 1959 the Jelcza Motor-Vehicle Plant undertook the new task of launching into production and carrying out on an experimental basis a number (25 units) of "Zubr" type 8-ton trucks with high-pressure engines. The documentation is being prepared by the Automotive Industry Designing Office in Warsaw.

The production of the "Zubr" truck is based on cooperation between various plants, whereby the Jelcza Motoro-Vehicle Plant is expected--in the inital stage--to produce the auxiliary assemblies forthe chassis, to carry out the welding of the frames, to produce the complete cabin and platform body, as well as to assemble the entire truck.

The "Zubr" truck, which is designed for the transportation of goods, is also adapted for ahuling trailers. Its maximum speed is 72 kilometers per hour. Alongside the production of the "Zubr" truck, the Jelcza Motor-Vehicle Plant will launch in the course of this year the production of

inter-city buses (based on Czechoslovak documentation) on imported Skoda 706 RT O chassis.

The production will be launched with the assistance of Czech experts from the "Karosa" Plant, whereby the first lot of buses will be produced with components delivered from Czechoslovakia; these will gradually be eliminated and replaced by domestically manufactured parts and components.

The long-range plan of the plant calls for the production in 1965 of 1,500 to 2,000 "Zubr" trucks and its derivatives, 1,200 heavy-duty buses, 350 various types of fire trucks, and 1,000 various vans mounted on "Star" chassis.

Photo Captions

Figure 1. Type SBA-2000/16 fire engine

Figure 2. Eight-ton "Zubr" truck.

1291

POLAND

M-5 Lower Silesian Electrical Machinery Production Plants in Wroclaw

[This is a translation of an article by Engrs Edmund Zasada, Edmund Sikorowski, and Boleslaw Liszka in Przeglad Mechaniczny, Vol XVIII, No2, 25 November 1959, Warsaw, pages 736-738; CSO: 3567-N/6]

Brief Historical Outline

The Electrical Machinery Plant was organized as a result of a government decision on 1 February 1946. By order of the then acting Minister of Industry and Commerce issued on 14 January 1947, the plant facilities remaining from the former German "FAMO" plant in Wroclaw were designated for that purpose.

The state of the premises was deplorable. The production halls and auxiliary facilities were destroyed during the hostilities. The mechanical equipment, production, and transportation facilities were not nonexistent, all social facilities were also in ruins.

The intensive restoration of the destroyed plant premises began on 1 June 1947, and by the end of 1948 the motor and transformer repair shops were already in operation and the production of new transformers were launched. The value of production for 1948 reached 581,500 zlotys.

The proper reconstruction and expansion period, however, did not begin before 1951, after the technical plan of the plant was developed and approved. The final production program of the plant was crystallized at the same time. This program calls for the production of 2.5- to 100-megawatt generators, hydraulic generators of capacities up to 25 megawatts, synchronous compensators of capacities up to 15,000 kilovolt amperes, 500- to 2,500-kilowatt direct current motors, locomotive engines, three-section trains, tramways, trolleys, and subway cars, and asynchronous motors of capacities ranging from 450 to 1,000 kilowatts.

By 1959, 80 percent of all the productinn premises, occupying an area of about 50,000 square meters, were restored and organized, while the entire plant, including the auxiliary facilities, is expected to be completed by 1961.

The production of turbo-generator sets of capacities ranging between 2.5, 4, 25, and 30 megawatts, 50-megawatt generators, engines for electrical locomotives, three-section trains and tramways, as well as a number of auxiliary traction machines had been mastered by 1959. The manufacture of other assortments was basically mastered within the production framework of the technical plan of the plant.

A separate chapter in the history of the plant is the problem of selecting and training personnel. The personnel is rather young. For the majority of workers the M-5 plant was their first experience with shop production.

In spite of the significant production results so far achieved, the plant management continues to run into difficulties in its effort to carry out the production plan and to expand the plant at the same time.

Problems of Technical Advance

The technical advance plan of the pst three years was based on the actual needs of the plant, with due consideration to long-range development in the future.

Among the outstanding realizations of 1957, the 25-megawatt generator produced for the first time in Poland under Soviet license, counts as one of the most significant achievements of the more important technical achievements of 1958, the production of first a prototype and then of a series of 1,000-kilowatt asynchronous motors, as well as the launching into production of mico-tapes [strips] should be mentioned. The year 1959 brought further very important achievements--the production of 30-and 50-megawatt (hydrogen-cooled) generators, a 2,500-kilowatt steel rolling motor, and an asynchronous steel rolling motor in tropical housing.

The guiding principles for the 1960-1965 plan of technical advance were based on the thoroughly worked out 1959 plan.

This plan calls for 120- and 200-megawatt turbo-generator sets; a series of 25 megawatt hydraulic generators; compensators of capacities up to 50 megavars (MVAr); a vertical asynchronous motor with a 5.2-megawatt exciter; a series of totally-enclosed asynchronous motors with vertical shaft and ventilating ducts of capacities up to 1,250 kilowatts; a series of explosion- and vapor-proof asynchronous squirrel-cage motors; asynchronous motors of capacities above 4,000 kilowatts with Leonard speed drives; high-speed asynchronous motors of capacities above 3,150 kilowatts; and locomotive engines of 800 and 1,500 horsepower capacities.

The 1960-1965 plan also sets forth numerous tasks connected with scientific and research work and organizational and technical problems, as well as the introduction of new technological processes.

Production of Machines and Equipment for Electric Traction

Electric motors, and drive motors in particular, are the basic elements of electric-powered vehicles. In view of the special working conditions, their construction differs considerably from that of normal electrical equipment.

The M-5 plants produce machines for tramways, locomotives, and three-section electric motor cars. All the machines discussed below are direct current equipment.

Tramway Motors

Type LT-31 motor (Figure 1) is used by all MPK's (Municipal Transportation Enterprise) in Poland. It is also applied in the Bo Bo type electric locomotive.

The method of suspending the motor in the trolley is typical for all traction engines. According to this method, one side of the motor is suspended on the driving axle of the wheel assembly, while the other is mounted on the trolley fram. The torque of the motor is transmitted by means of a single-step tooth-gear, whose small gear is mounted on the motor shaft, and the large one is mounted on the driving axle of the wheel assembly.

Type L Ta-22 motor (Figure 2) is used in the advanced type IIN high-speed tramway. The torque is transmitted on the mounted axle by means of a double-step tooth-gear.

Machines for Electric Locomotives

The machines described below are used in type E-O6 electrical locomotives.

Type LKa-635 motor (Figure 3) is similar in its design to type LT-31 tramway motor. The torque is transmitted by means of a double-step tooth gear.

Type LKPa- (353 + 282) auxiliary set (Figure 4) consists of two machines coupled on a common shaft--a type LKPa-353 drive motor and a type LKPa-282 generator--which supplies the auxiliary circuits of the locomotive. A fan is mounted at the end of the motor shaft.

Type LKP-354 motor (Figure 5) serves for powering the type E-500 compressor, which supplies the pneumatic system of the locomotive. The motor and compressor have a common shaft.

Machines for Three-Section Electric Motor Cars

The machines described below are used in type EW-55 three-section electric motor cars.

Type LKa-450 motor (Figure 6) is suspended in the same way s the LT-31 and LKa-635 motors. The torque is transmitted by means of a single-step tooth-gear.

Type LKPa-330 converter is an auxiliary machine consisting of drive motor and generator which supplies the auxiliary circuits of the three-section electric motor car.

Type LKPa-280 motor serves for powering the compressor which supplies the pneumatic system of the motor car. Its rotor of the motor is mounted on the compressor shaft.

Electrical Equipment

The M-5 plants also produce pantographs, induction shunts to reduce the excitation current of drive motors, manual pumps for pneumatic operation of pantographs, cable connectors, and terminal boards.

The Five-Year Plan sets new important tasks for the M-5 plants. This plan calls for the electrification of about 900 kilometers of railroad lines. In connection with this, increased production of electrical equipment, which plays a major role in the electrification project, is a basic condition for the fulfillment of that plan.

Photo Captions

Figure 1. Type LT-31 tramway drive motor

Figure 2. Type LT-220 tramway drive motor

Figure 3. Type LKa-635 drive motor for electric locomotive

Figure 4. Type LKPa- (353 + 282) auxiliary set

Figure 5. Type LKPa-354 compressor motor

Figure 6. Type LKa-450 drive motor for three-section electric motor car

Figure 7. Type LKPa-330 converter

1291

POLAND

Low-Voltage Control Apparatus

[This is a translation of an article by Engr Zdzislaw Nowicki in Przeglad Mechaniczny, Vol XVIII, No 2, 25 November 1959, Warsaw, pages 739-740; CSO: 3657-N/7]

The A-18 Lower Silesian Precision Apparatus Production Plants in Zabkowice were established in place of the former German Fountain Pen Factory. In 1946 the plant occupied a single building in Zabkowice, Silesia, and had 200 employees. The development of the plant followed the systematic development of the economic life in the Western Territories. In 1955, at a time of intensive development of production, it became necessary to expand the premises for the assembly department. The plant then obtained a three-story building where the newly organized assembly lines were installed. In 1957 a new department for the production of small modern type SM-0 and SM-1 contactors was extablished in Zloty Stok.

At present the plant has its own stamping shop for synthetic products. By 1965 the plant expects to open a stamping shop for deep stamping of sheet metal as well as a central screw factory, which will supply to all the plants belonging to the Association of the Electrical Machinery and Apparatus Industry.

The production of the plant tripled during the 1950-1959 period. At present the plant is producing 35,000 units of apparatuses monthly, employing 1,200 persons.

The current production of the plant is of basic importance for the development of the mechanization and automation of industrial technological processes. The Lower Silesian A-18 Precision Apparatus Production Plants in Zabkowice manufacture circuit breakers, contactors, micro-switches, interrupters, etc.

Circuit breakers can be divided into: 1) circuit breakers for the protection and control of single- and three-phase lighting and heating circuits; and 2) circuit breakers for

the protection and control of electric single- and three-phase motors.

Type N-101-II-25 and N-102-III-15 circuit breakers belong to the first group.

Type N-101-II-25 is a double-pole circuit breaker, which protects a controlled lighting or heating circuit against short-circuits and overloading. The current rating of the breaker is 25 amperes at 380 volts, 50-cycle alternating current, and 25 amperes at 250 volts direct current. The largest short circuit current which the breaker can interrupt safely amounts to 1,500 amperes.

The above circuit breaker finds wide application in the protection of lighting circuits in five- and ten-circuit panels, and it can successfully replace the fuses formerly used.

Type N-102-III-15 (Figure 1) is a three-pole circuit breaker, which protects the electric circuit against shorts and over-loadings. Its current rating is 15 amperes at 380 volts, 50-cycle alternating current.

At present the plant designing office has developed a new type of single-pole breaker for the protection and control of lighting circuits. No single-pole circuit breakers have yet been manufactured in Poland.

Types N-102-II-L, N-103-III-8, N-104-III-20, and AP-III-25 circuit breakers belong to the second group.

Type N-102-II-L circuit breaker is similar in design and ratings to type N-101-II-25 as breaker described above, except that the trips are adapted for the protection of very small capacity electric single-phase motors. The current rating of the circuit breaker is 3 amperes at 220 volts, 50-cycle alternating current. The breaker has been specially adapted for the control of electric motors in refrigeration equipment (refrigerators).

Type N-103-III-8 (Figure 3) circuit breaker serves for the control of electric three-phase motors. It is provided with a thermal overload trip element (0.35 to 8.0 amperes), which protects the motor against overloading. Properly coordinated fuses must also be used for short-circuit protection. The current rating of the breaker is 8 amperes at 380 volts, 50-cycle alternating current.

Type N-104-III-20 (Figure 4) circuit breaker is used for the control of electric three-phase motors. The breaker is provided with a thermal overload trip element (0.6 to 23 amperes) and a magnetic trip, and it protects the motors against short circuits as well as overloading. It can also be provided with an auxiliary contact. The current rating of this circuit breaker is 20 amperes at 380 volts, 50-cycle alternating current.

Type AP-III-25 (Figure 5) circuit breaker is used for the control of electric three-phase motors. It is provided with thermal (0.6 to 0.25 amperes) as well as magnetic tripping devices, and an anti-shock system which protects the personnel against electric shocks in case the protected equipment proves to be under voltage. The current rating of the breaker is 25 amperes at 500 volts, 50-cycle alternating current.

Contactors are manufactured in three different sizes.

Type SM-0 (Figure 6) four-pole contactor is equipped with a single (auxiliary) operating contact. It can also be adapted as a contactor-interrupter. The magnetic coil can be made for 24,125, 220, 380, and 500 volts, 50- to 60-cycle alternating current, as well as for 24, 30, and 110 volts direct current. The current rating of the contactor is 8 amperes at 500 volts, 50- to 60-cycle alternating current. It is used for the remote control of electric motors and circuits. The contactor can also be provided with a thermal relay protecting the controller circuit against overloading.

It can be installed without enclosure or in a metal enclosure.

Type SM-1 (Figure 7) three-pole contactor is equipped with two auxiliary operating as well as two inactive contacts. The current rating of the contactor is 15 amperes at 500 volts. All the other operating data are the same as for the type SM-0 contactor.

The above type SM-0 and SM-1 contactos are of advanced design. Their main features are small dimensions, calssification which at the rated load, guarantees 500,000 contact connections, and high permissible frequency of connections (1,000 per hour).

These are widely applied in industrial automatic installation and in the machine tool industry, where they serve for the control of electric motors. Owing to the above advantages, they can replace imported control apparatuses and are also exported.

Type N-107-III-40 (Figure 8) contactor is equipped with one pair of auxiliary operating and one pair of inactive contacts. Its current rating is 40 amperes at 500 volts, 50-cycle alternating current. The contactor is provided with a type N-154 thermal relay and an anti-shock system. It is used for the control of electric motors of capacities up to 20 kilowatts at 50 volts. Its anti-shock system makes its application desirable in places whre such danger exists (construction, mining, etc.).

Type MP micro-switches (Figure 9) are manufactured in six versions. Each version differs from the others by the pressure of the control contact (shaft, switch toggle) or the location for which it is designed (for example, type MP-2 micro-switch, when applied in dusty locations, is mounted in a dustproof enclosure and classified as MP-4).

Type MP micro-switches are used as switches, interrupters, transfer switches, or limit switches. They are also applied in contactor control circuits. Their application range is very wide and depends to a large extent upon the ingenuity of their users.

Type AM-12 direction indicating blinker light interrupters (Fgiure 10) are devices operating on thermo-electromagnetic principles. They are used in motor-vehicles as direction indicators. Their watt ratings are 40 watts at 12 volts and 30 watts at 6 volts.

Type AM-12 interrupter was designed in the plant designing office and exceeds in its ingenuity many foreign designs of the same type.

Besides the above-mentioned products, the A-18 plant also produces tramway heaters for 600 watts at 600 volt alternating and direct current, as well as thermal regulators for electric irons.

Photo Captions

Figure 1. Type N-102-III-15 circuit breaker

Figure 2. Type N-102-II-L circuit breaker

Figure 3. Type N-103-III-8 circuit breaker

Figure 4. Type N-104-III-20 circuit breaker

Figure 5. Type AP-III-25 circuit breaker

Figure 6. Type SM-0 contactor

Figure 7. Type SM-1 contactor

Figure 8. Type N-107-III-40 contactor

Figure 9. Type MP micro-switch

Figure 10. Type AM-12 directional blinker light interrupter

1291

POLAND

"Diora" Radio Plants in Dzierzoniow

[This is a translation of an article by Engrs Bohdan Bankowski, Jan Galar, and Bronislawa Sterma in Przeglad Mechaniczny, Vol XVIII, No 2, 25 November 1959, Warsaw, pages 741-744; CSO: 3567-N/8]

The "Diora" Radio Plants in Dzierzoniow produces at present about 60 percent of the domestically produced radio receiver sets. This amounts to about 600 million zlotys' worth a year.

The above plants, up to 1957 known as the Lower Silesian Radio Equipment Plants, were the first after the war to launch the production of new radio receiver sets. Their experience was utilized in the construction and organization of such plants as the M. Kasprzak Radio Plant in Warsaw and the Warsaw Television Plant.

Foundation of the "Diora" Radio Plants

The radio plant in Dzierzoniow was organized in October 1945 on premises occupied in in 1943 by a weaving mill, which was later destroyed as a result of the hostilities.

The work connected with setting the plant into operation was started from scratch. Shortages of materials and labor and limited transportation means were among the difficulties which had to be overcome in order to restore the usefulness of the destroyed buildings. Machinery was organized by carting machine tools from the abandoned p ants, mostly obsolete or out of order. The year 1946 was a period during which the available machinery and equipment were repaired and restored to usable condition. The new production departments were also organized during that time.

The first deparatment set into operation was the tool room, which was followed by a machine shop, a winding shop,

a galvanizing shop, a bakelite treatment shop, and an assembly department. The production of an experimental series of "Yaxley" type wave-band switches was launched as early as 1946. The documentation and tooling for that series were prepared under very difficult conditions. Owing to scarcity of design personnel and lack of equipment.

The next development stage of the plant was characterized by the production of double-circuit receivers mounted on various types of chassis. About 400 of these receivers were released under the name of "Srebrny Ton" [Silver Tone].

The actual production, however, began only at the time the license for the popular Swedish "Agh" receiver set was purchased.

From the "Pionier" to the "Symfonia"

Parallel with the launching of the licensed production, a designing and technological office, whose task was to develop a domestic receiver set, was organized. In 1948, as a result of this work, the first Polish postwar radio receiver set, the "Pionier U1", was created. It was a four-tube superheterodyne with three wave-band ranges, which won great popularity in the country.

The next type of receiver, the "Mazur" already assembled by the assembly line method, was developed on the basis of experience acquired through the production of the "Pionier". From that moment on, the "Diora" Radio Plant switched to mass production (Figure 1).

In view of the relatively great demand for radio receiver sets on the market in 1945-1955, the principal and primary task of the plant was to satisfy these demands quantitatively. Owing to this policy, the number of assortments produced by the plant was limited to third-class receiver sets.

A change took place only in 1955, when, partly because of the partial saturation of the market, and partly because of the further expansion of production planning offices, a number of new assortments was introduced.

During that period, such radio sets as "Slask," shown in Figure 2, were produced. At present the assortment of radio sets produced by the "Diora" Radio Plant s basically meets all the consumers' demands in the field of popular receivers (Figure 3) as well as receivers of medium and higher quality (Figures 2 and 4).

So far the plants have delivered to the market a total of over 20 types of radio receivers.

Advance in the Design of Receivers

The growing performance requirements of receivers with respect to the quality of manufactured receivers caused basic changes in their design and execution, compared with that of the initial period.

The efforts of the designers were directed towards

[a] better sound reproduction;
[b] modernization and improvement of the appearance of the receiver;
[c] development of the receiver.

In order to improve the fidelity of the sound high-class receivers were equipped with multi-speaker systems, which reproduce a wider frequency band. Essential changes were also introduced into the electrical system of the receiver, where, among other things, better receiving conditions were created through the introduction of a separate frequency modulation range.

A basic change, which affected the appearance as well as the operation of the receiver, was the introduction of the keyboard type wave-band switch. The technological and design advantages connected with the introduction of the keyboard type switch determined its wide application in radio receivers.

The present development trends favor the design of combination radio receiver and phonograph sets, which are represented in the popular receiver class (for example, "Poemat II') as well as in the higher class (for example, "Symfonia" Figure 4).

Technological Problems

The technological requirements of radio receivers grow with the development of their design. In connection with this, high-quality components are required.

In order to achieve this end, bakelite materials are replaced to an increasing extent with other materials, such as melamine and polystyrene. The technological advantages of polystyrene, as well as its mechanical and electrical properties, lead to its wide application, especially for decorative purposes. The recently developed "Kos" receiver (Figure 5)--whose housing, knowbs, and scale are made of polystyrene--could be taken as an example.

Since the decorative elements of radio receivers executed of M63 sheet metal have a number of deficiencies (for example, low resistance to corrosion and high polishing cost), numerous tests have been conducted to find a better solution. Finally it was decided to replace the brass with aluminum, which, after having undergone mechanical treatment, will be polished, "eloxolized" (eloksalowana), and painted by the electro-chemical method. The application of this technological method will considerably improve the quality of the product and reduce the present treatment cost by two thirds.

Printed Circuits

The trend toward mechanization and automation of all technological processes in industry lead to the introduction of so-called printed circuits into the design of electronic devices.

The above method is based on the substitution of the conventional wiring by a system of wiring printed on a plate of insulating material, which replaces the conventional "chassis".

The conductors, in the form of about 40-micron thick copper bands, are shaped on a plate (Figure 6). This wiring system is obtained by the so-called sieve-printing method. The print protects the places covered before the application of an eluter. The plate with the print is subjected to the action of an eluter, as a result of which a wiring system is obtained on the plate.

The application of this method permits full automation of wiring operations, including soldering of wires, which takes place simultaneously for all soldering points.

The second important advantage of this method is the high stability of the electrical parameters of the receiver, thanks to the identical localization of all components and conductors in the given series. This will considerably reduce the number of control and regulation operations.

In consequence of the work on the technology of printed circuits carried out at the "Diora" Radio Plant, a popular version of the "Dos" printed circuit receiver, which will soon be put into production, was developed.

The introduction of this method is closely connected with the mastering of a number of new techniques, such as the sieve-printing mentioned above or soldering with the aid of a standing wave-soldering alloy created in a suitable device.

Automatic wiring requires adequate automatic equipment, which would be applicable to various types of circuits. In view of the lack of such devices on the market, the plant is obliged to resort to their individual development.

Production Development Prospects for the "Diora" Radio Plants

The development of production planned for the near future will proceed in three directions:

[a] Development of new receiver types and their production;
[b] Production of television sets;
[c] Production of intercommunication means for industrial enterprises.

In thenear future, such receivers as "Juhas II" (transistorized battery receiver); "Kos" (popular receiver with three wave ranges, and three tubes in a polystyrene housing); "Calypso" (modern, with four wave ranges, six tubes, two speakers, tuning indicator, and ferrite antenna--(Figure 7) are all expected to appear on the market.

In 1965 the production of the "Diora" Radio Plants is expected to reach a total of over two million receivers.

The first eight-channel television sets with 14- and 17-inch screens produced by the "Diora" Radio Plants will also be put on the market in 1960. By 1965 the production of television sets is expected to reach about 200,000.

Furthermore, the "Diora" Radio Plants, as the first in Poland, will begin the production of mine radio telephones. Preliminary data indicate that, under normal working conditions in a mine, the radio telephone will ensure communication at distances up to 1,000 meters. Such a device will operate on frequency modulation. Its weight will amount to about four kilograms. About 1,500 such radio telephones are expected to be produced by 1965.

Marketing Problems

The partial saturation of the market with domestically manufactured receivers, which ensued as a result of the activities of radio plants, is felt to an increasing extent. This forces the plants, on the one hand, to make their products more attractive to the customers by supplying them with more advanced receivers, and on the other hand--to become more interested in foreign markets.

Export production under our conditions calls for specific requirements which cannot always be easily fulfilled. There is still much to be desired, especially in the fireld of finishing, because very often the external appearance of our receivers does not match their actual quality. This condition has recently improved and the new series of such receivers as "Kos"or "Calypso" will be ina position to compete effectively with receivers manufactured by foreign firms.

In the past "Diora" products have been exported only to the Near East and to African countries, and basically only recognized models were delivered. The transactions concluded by the "Diora" plants with foreign buyers at the Poznan Fair last year indicate that this situation is changing in favor of the plant.

In addition to improving the quality of presently produced assortments, the volume of exports will affect the planning of production with respect to transistor receivers and television sets.

Photo Captions

Figure 1. Wiring of radio receiver sets at the"Diora" Radio Plants

Figure 2. "Slask" radio receiver

Figure 3. "Sonatina" radio receiver

Figure 4. "Symfonia" radio receiver

Figure 5. "Kos" radio receiver

Figure 6. Plate with printed circuit of the "Kos" radio receiver

Figure 7. "Calypso" radio receiver

1291

POLAND

Gas Plant Building Enterprises

[This is a translation of an article by Engr Ryszard Zygmunt in Przeglad Mechaniczny, Vol XVIII, No 2, 25 November 1959, Warsaw, page 748; CSO: 3667-N/9]

The Gas Plant Building Enterprise was founded in 1952. Its work includes the construction equipment and installation of gas furnaces, in operating as well as newly built gas plants.

The gas plants in Wroclaw Wojewodztwo constitute one of the major concentrations of this kind of plant in Poland. In order to meet the demands connected with the reconstruction and expansion of gas works, a section of the Gas Plant Building Enterprise was organized in Wroclaw, which will service Wroclaw Opole, Katowice, and Krakow Wojewodztwos. Most of the work, however, is being carried out by the Wroclaw section in the Wroclaw Wojewodztwo area.

Over 80 percent of the existing gas plants were reconstructed or restored by the Gas Plant Building Enterprise.

The facilities in old-type gas plants were very versatile which caused a lot of trouble in the ordering of materials (ceramics in the first place), as well as in carrying out the work itself.

In order to systematize the work and introduce standard materials and equipment, the Gas Plant Building Enterprise organized--in addition to its "Gazoprojekt" Gas Plant Planning Office--a design workshop. The range of work conducted by the Gas Plant Building Enterprise is very broad and is consistently expanding. The production capacity (of the Wroclaw section) is also increasing. In 1959 it reached 470 percent of the 1952 capacity and about 150 percent of the 1947 capacity.

The production tasks for 1960 and the following years are even higher in connection with the considerable development of the industry and expansion of citieis in Lower Silesia.

The scope of work of the Gas Plant Building Enterprise includes the construction and restoration of the following facilities:

Retort gas furnaces
Vertical compartment kilns
Horizontal-compartment and oblique-compartments kilns
Various type gas generators
Control and machine room equipment
Construction of production pipe lines
Cottrell [or electric] filters
Steam boilers
Ammonium and benzine rinsing facilities
Gas desulfurizing facilities
Various types of gas refrigerators
Coal hoists
Transportation and grading equipment
Damping towers
Gas tanks

Photo Captions

Figure 1. Gas generator plant

Figure 2. Vertical-compartment furnace

Figure 3. Gas tank

Figure 4. Vertical-compartment furnace (gas outlets from the compartments)

1291

POLAND

"Chocianow" Mechanical Equipment Plant in Chocianow

[This is a translation of an article by Ferdynand Blauciak, manager, in Przeglad Mechaniczny, Vol XVIII, No 2, 25 November 1959, Warsaw, pages 748-749; CSO: 3667-N/10]

The "Chocianow" Mechanical Equipment Plant in Chocianow is basically specialized in the production of medium size vertical drilling machines.

In 1951 the plant was producing only machine casts and molds--both for selling purposes. At the same time preparations for the production of drilling machines were under way. In 1953 the efforts of the personnel were rewarded by the completion of a prototype of the type WKA-25 drilling machine.

The year 1954 brought further expansion to all departments: mechanical, assembly, and tool departments. The first series of type WKA-25 drilling machines--58 in all--were produced during that same year. This year could be considered the turning point for the "Chocianow" plant personnel, because since then progress has been made not only in carrying out the plan but even in exceeding the monthly plans.

Since 1955 the production assortment has been enriched by one more type WE-20 drilling machine. In addition to the 140 type WKA-25 drilling machines, 675 type WE-20 drilling machines were produced.

The years 1956-1958 are characterized by a further dynamic development of the plant. The production of type WE-20 drilling machines increased from 675 (produced in 1955) to 810, and the production of type WKA-25 from 140 to 402. Furthermore, the production of type WRc-25 drilling machines, seven of which were produced in 1958, was launched. During that same period, a prototype of the type WKA-40 drilling machine was produced. However, in view of the great demand for this type of drilling machine, which for objective reasons could not be met by the plant, their production was transferred to the Rzeszow Transportation Equipment Plant.

The type WKA-25 and WE-20 drilling machines are known not only in this country but abroad as well. The "Chofum" trade mark won popularity, in such countries as Yugoslavia, Turkey, China, Korea, Luxembourg, Vietnam, Brazil, Sweden, England, and Egypt.

In 1959 the production of the "Chocianow" FUM[Mechanical Equipment Plant] continued to increase qualitatively as well as quantitatively. In accordance with the plan, the number of type WKA-25 drilling machines produced approaches 450, while the number of type WE-20 drilling machines--in view of the introduction of more advanced models--is dropping to 500. The production of type WRc-25 drilling machines is increasing to 30, type WKB-63 to 30, and type WE-25 to 300.

From the above data it results that the production during the entire described period is characterized by dynamic development. It should be added that in the middle of June of this year the 5,000th drilling machine left the assembly hall.

Since its very beginning the "Chocianow" FUM has been producing, in addition to drilling machines, molds for its own needs as well as for those of its customers. In this field the production also increased considerably. Where in 1951 the casting department produced 296 tons of casts, the 1959 plan calls for the production of 4,200 tons.

The main buyers of casts produced by the "Chocianow" FUM are the Wroclaw FUM, the Warsaw Press Plant, the Tarnobrzeg FUM, the Warka FUM, the Pruszkow CBKO [Central Ship Designing Office], the Andrychow FUM, and the Glogow FMB [Building Machinery Factory].

Parallel with the production of new type drilling machines, experiments with the prupose of producing paper cylinders for the Cieplice Paper Machinery Factory were conducted. After a time the experiments yielded favorable results and the production of paper cylinders began for the first time in Poland. This achievement may certainly be considered as a success on the European scale. The first good cylinders, in the number of 12, were released in 1958 and were considered as anti-import production, in view of the fact that up to then they had had to be imported from abroad. Owing to the launching of this production, the Ciplice Paper Machinery Factory became to a great extent independent of the import of

paper cylinders, which had consumed considerable amounts of foreign currency.

The basic development indices of the "Chocianow" FUM for 1960-1965 run as follows: the over-all production in 1965 will increase78 percent with respect to the expected 1959 production. This pertains to quantitative as well as qualitative growth. The production of paper cylinders, which during the five-year period is expected to reach a total of 600, deserves particular attention.

In agreement with the plan, the "Chocianow" FUM is expected, in the immediate future, to fully satisfy the demands of the Cieplice Paper Machinery Factory for paper cylinders, as well as those of the entire domestic paper industry. In this way the problem of importing paper cylinders will be entirely solved. What is more, the paper cylinders manufactured by the "Chocianow" FUM will become a valuable export product, since the Cieplice Paper Machinery Plant designates a major part of its production for export.

At present the "Chocianow" FUM is not being basically expanded. The entire attention of the management is concentrated on the problem of further mechanization and modernization of the production process.

1291

POLAND

The Port of Gdansk in the Five-Year Plan 1961-1965

[This is a translation of an article by Magister B. Kihan of the Gdansk Port Administration (Zarzad Portu Gdansk), in Technika i Gospodarka Morska, Vol IX, No 11, November 1959, Gdynia, pages 341-342, CSO:3669-N/a]

In the course of the recent fundamental discussion on the development of the part of Gdansk in the future Five-Year Plan, it was decided what the main trends of the new plan should be. It is expected that in 1965 the loading turnover will reach 5.3 million tons. This figure should be considered a minimum general idea, since last year the port reloaded about 5 million tons. Thus, it is to be expected that the planned assumptions will be considerably exceeded. As for the division into individual product groups, it is as follows: coal, 2,300,000 tons; ore, 800,000 tons; lumber, 350,000 tons; general cargo, 1,300,000 tons and grain, 300,000 tons. It follows from this that the port of Gdansk retains its universal character and the present structure of a cargo will be changed considerably. The share of bulk and semi-bulk products will decrease, while there will be an increase in the reloading of general cargo.

Despite the more difficult technology of reloading and an increase in its labor absorption, the basic qualitative indices of the work of the port should be radically improved. It is assumed, among other things, that the speed of servicing ships will increase by 44 percent and th time of their stay in port will be cut by an average of 15 to 20 percent. Similarly, an increase of 33 percent in the productivity of labor of reloading brigades is expected.

The implementation of these tasks would not be possible with the present operational and technical potential of the port and with the present methods of organization and technology of reloading. In these fields it is necessary to more forward very extensively. In connection with this it is expected, apart from new investments, to attain a possibly complete mechanization of reloading of general cargo in fields and in warehouses and a further expansion of the scope of mechanization in stowing general cargo. The mechani-

zation of heavy reloading work would guarantee fast servicing of the ship, less effort on the part of the workers, and a reduction in employment. The new Five-Year Plan should also solve the difficult problem of mechanization of lumber reloading and, as concerns bulk cargoes, the problem of further mechanization of trimming, [presumably, installing shifting boards].

Directly connected with the problem of mechanization is the question of adapting all general cargo quais for work with mechanized equipment and the provision of repair and technical facilities for that equipment.

The problem of improving the professional skills of the port staff should be solved by means of all-round training. In the new situation it will also be possible to introduce several new and better technological solutions. Apart from specialization of reloading brigades, the part of Gdansk has the ambitious task of increasing the production utilization of the working day by at least 85 percent.

In speaking of port cadres the very important matter of the volume of employment of the basic group of employees--namely, the reloading workers--should be mentioned. The problem is that the planned reserve of 201 workers (14 percent of the total) is definitely too small to cover fluctuations in employment connected with the nonuniformity of reloading. According to past experience, this reserve should be greater, especially since in the future the non-uniform influx of cargoes to the port will also create "peaks" and "jams." No basic changes should be expected in this connection.

Investment allocations were lowered in compartison with the orginal assumptions by over 100 million zlotys (in the Seven-Year Plan--that is, for 1959-1965--they were lowered by 175 million zlotys), and it was not taken into account that the costs of individual hydrotechnical jobs and investment purchases increase from year to year. The port of Gdansk became engaged in very costly long-range hydrotechnical jobs (not undertaken in other ports), connected with the reconstruction of the Port Channel.

In connection with this, to keep within the limits of the allocations, the port will have to give up serveral planned investments--namely, the reconstruction of the Mewy quai, completion of construction of the Westerplatte quai, cutting

The Curve of Five Whistles, the demolition of the eastern braker, and the reconstruction of the Oliwa quai.

It would be particularly painful for the port to abandon the completion of jobs in the Port Channel region. Even now the entrance to the port of Gdansk and the curve at port capitaincy do not give full traffic and shipping safety. The sailing route in the Port Channel will become constantly narrower and shallower because water undermines the embankment on the side of the Westerplatte quai and brings mud into the water route. Thus, every year that prolongs the investments in that region causes additional losses for the national economy because the amount that will have to be spent after the completion of the investment to deepen the Port Channel increases. For this reason this item in the investment outlays should be preserved at the figure planned in the orginal assumptions.

It seems that it cannot be required that the Port Administration, complete the work in the Port Channel at the cost of relinquishing basic investments, increase its operational and technical potential, and ensuring the execution of the reloading tasks given to the port in the Five-Year Plan. A situation could then arise in which the port would not have the number of installations necessary for the execution of current reloading work. Since, apart from the Port Administration, the users of the port are the Gdansk Shipyard (Stocznia Gdanska) and the CPN [Centrala Produktow Naftowych; Petroleum Products Center], both the Ministry of Machine Industry and the Ministry of Chemical Industry should make efforts to obtain additional investment credits for this purpose. In even a few years, if the port Channel is not reconstructed, larger ships built by the shipyard will not be able to exit from it. The same applies to the entry of large tankers (above 20,000 deadweight tons) unloading liquid fuel at the CPN reservoirs.

Among other port investments, it is first of all necessary to call attention to the planned addition of reloading installations and warehouse space to the quais at the Wladyslaw IV dock. These quais are the busiest in the port of Gdansk; they contain the Chinese and Swedish-Finnish line bases and show a tendency toward increased turnover. The Five-Year Plan provides for the construction of a warehouse of the second line in the Marchlewski quai and the purchase, from import, of three Dutch 3 to 6 ton cranes with a reach of up to 32 meters. The Warynski quai will receive six general cargo 3-

to 6-ton cranes with a long reach. The surface of the fields will also be reconstructed. The existing so-called social building (cloak room, baths, waiting room) will be expanded to accommodate another 350 persons.

Reloading Region II constitutes, among other things, the base of the Levant line. In the next few years serious modernization is planned on this sector. Some of the reconstruction projects are the old part of the Vistula Terminus (Dworzec Wislany) quai (length about 300 linear meters), the "Vistula" warehouse, and the surface and approach roads for mechanized transport. The addition of five 3-ton cranes and an installation for trimming powdery cargoes in covered cars should basically ensure the execution of the reloading targets of this sector of the port.

However, one more very essential problem emerges here. There is no doubt that the problem of expansion and adaptation of the port railroad junction is strictly connected with the modernization and expansion of the port. It has to be admitted that the railroads did not do enough in this direction. Meanwhile, the increasing port turnover requires efficient railroad service. Improperly or insufficiently solved railroad problems may cause delays and lower the quality of servicing the ships.

In the port of Gdansk it is urgently necessary to reconstruct the Zaspa rail junctions (direct connection between the Zaspa station and the quais of the Wladyslaw IV dock) and the Vistula Terminus junction (transfer of the freight station in the direction of Letniewo). It should be remembered that nearly 70 percent of the reloading of general cargo will be concentrated on the Wladyslaw IV dock--that is, over 900,000 tons a year, and about 800,000 tons of general and bulk cargo and grain will be handled in the Vistual Terminus region. The present set-up of tracks and other railroad constructions does not guarantee a uniform and punctual railroad service for reloading operations.

The railroad ministry should once again revise its investment intentions concerning work connected with the reconstruction of the above-mentioned rail junctions in the port of Gdansk.

In connection with the development of the Vistula Terminus it should be mentioned that the correct decision to localize the central supply warehouses and a transport base

in the hinterland of the Vistula Terminus is ready for implementation. The problem is that the proper investment allocations for these projects hould be included in the latest version of the plan.

The modernization of the mining dock was to consist partly of the reconstruction and deepening of the ore quai. This solution was finally abandoned (lack of credits). At present another concept is in the course of implementation, which consists of placing pontoons 3 to 5 meters wide at the ore quai. In this way large ore ships would be able to enter the dock and stop 3 to 5 meters from the quai, closer to the main stream where the depth is greater. In addition the ore quai will be equipped with seven new 10-ton cranes and one 10 to 15-ton bridge. The Coal quai will also receive four 10-ton cranes and a coal bunker.

Especially noteworthy is the fact that in the next five years the problem of mechanization of lumber reloading, which is most difficult for the workers and very labor-absorbing, will be solved. It is psecifically planned to cover with concrete about 60,000 square meters of the lumber port area in the first stage, construct loading installations ("wiaty"), a shed for plywood, and purchase a proper quantity of tractors, small locomotives, self-propelled cranes, laying machines, etc. This will greatly speed up the reloading work and facilitate important employment cuts in the lumber port.

A very essential matter which should be solved in the forthcoming five years is the activation of the industrial quai at the Kaszuby Canal. It is true that the plan provides solely for the construction of a warehouse and the purchase of four 3-ton cranes, but much more should be done here. If the port intends to concentrate here the reloading base for the export of agricultural and forest products and an import base for southern fruit, it is necessary to adapt the existing warehouses and other space, possibly at the expense of foreign trade enterprises. On the other hand, the intended conversion of the scarp quai into a "plate" one, will not take place in the next few years because of the high cost.

The total cost of purchasing mechanized equipment, both at home and abroad, will reach the sum of 38 million zlotys. This includes self-propelled cranes, laying machines, electric carts, small locomotives, etc. The floating equipment

will be increased by two floating cranes, five tugs, one port icebreaker, one pilot cutter, five general cargo barges, four motor boats, one bunker boat for liquid fuels, and one pontoon for the transport of heavy cargoes.

Among the general port investments in the Five-Year Plan it is intended to construct a transport base, central supply warehouses, central port workshops, an administration building, and a complete telephone and radio network for the port.

In the current programming premises for the port of Gdansk in the approaching Five-Year Plan there was no provision for the problem of location of the liquid fuel base.

There are various concepts for this, including the construction of a special petroleum port. However, nothign has been done so far in this field, and meanwhile the servicing of tankers does not give full security for the port. The port continues to hold to the concept of eliminating from its area the reloading of liquid fuels. Under these conditions there can be no possibility of expanding the existing base of liquid fuels. In the port only a small base for bunker purposes and port needs should remain.

One more problem: road investments. A considerable development of raod transport is expected in the Five-Year Plan. This means that a large quantity of products will be brought to the port in trucks. The state of the approach roads to the port is, to say the least, unsatisfactory. The municipal authorities of Gdansk should think about this. This applies to specific transport routes in the New Port and the construction of a road joining the New Port with Gdynia, via Brzezno, Jelitkowo, and Sopot. It is possible to utilize the existing hard road surface along the sea. This would shorten the route by 6 kilometers and relieve the only Gdansk-Gdynia route.

1291

POLAND

New Polish and Hungarian Port Cranes

[This is a translation of an unsigned article, in Technika i Gospodarka Morska, Vol IX, No 11, November 1959, Gdynia, pages 364-366, CSO: 3669-N/b]

New Type of the Side-Thrust Crane

In the No 1, 1956 issue of Technika i Gospodarka Morska we published an item on side-thrust cranes (zuraw boczno-wypadowy) designed abroad and based on Italian inventions. At present we return to this problem in connection with an interesting solution prepared by the Bureau of Maritime Construction Designs (Biuro Projektow Budownictwa Morskiego) in Gdansk.

The basis of the solution was an idea of Magister Engr St. Szwankowski, which the Mechanical Workshp (Pracownia Mechaniczna) of the BPBM [Biuro Projektow Budownictwa Morskiego; Bureau of Maritime Construction Designs] used to prepare a concept draft (author Magister Engr M. Morawski). Both inventors presented the design to the Patent Office (Urzad Patentowy), which recognized it as employee improvement No 15829.

The side-thrust crane has the purpose of:

1) Ensuring complete safety of work with simultaneous reloading with two or three cranes per hold.

2) Improving the working conditions of the crane operator, because the working movement is no longer rotary.

3) Shortening the cycle of work of the crane. According to a cdetailed analysis of the theoretical cycle of work, the reloading, in relation to a traditional crane with 44 cycles per hour, will be speeded up 21.6 percent. In reality, taking into account the time of work involved in attaching and detaching loads and waiting for the formation of sufficient load quantity the side-thrust crane will speed up the relaoding from 10 to 15 percent.

4) Giving additional advantages, in that the stay of ships,

the duration of which is determined by the so-called law of the largest hold, will be shorter because of the possibility of serving the largest hold with two or three cranes.

The experts who examined the solution--Prof Dr Engr a. Peatkiewicz and Magister Engr T. Bury--stated that the system of the side-thrust arm constitutes a interesting attempt to solve the difficulties occurring in port reloading with traditional types of cranes. The transfer of load solely with the aid of thrust will create much more advantageous conditions for the arms--particularly those consisting of one part--because in the case of a side-thrust crane the centrifugal forces can practically be ignored. It is much easier to eliminate a flat pendulum movement than a space pendulum movement. A further improvement is the possibility of attaining close proximity of cranes cooperating in unloading.

The experts considered the construction of a prototype to be most desirable. The continuation of further work on this type of crane was also found to be desirable by the Commission on Inventions (Komisja Wynalazczosci) of the Ministry of Shipping and Water Economy (Min. Zeglugi i Gospodarki Wodnej) (during a meeting on 15 October 1958).

The implementation of the next stage and the preparation by the BPBM of an expanded prliminary design (Engrs Morawski, Siwkowski, Nargiel) and of a model of the crane made it possible to formulate precisely the characteristics of the crane.

The principle of operation of the crane consists in the fact that the crane has all the basic characteristics of a conventional gantry rotational thrust crane, with the difference that the arm may be raised to the vertical level and inclined in the other side of the crane. Sucha solution facilitates the effecting of reloading with the use of only two movements--raising (or ,owering) of the hook, and change in reach.

The operator's cabin during change in reach turns in such a way that the operator always has the hook in front of his eyes. With a change in reach, the hook moves almost exactly in a horizontal plane, making a very flattened elliptical movement.

The possibility of concentrating side-thrust cranes is very great (for example, ten cranes serving a standard ship

with a loading capacity of 10 deadweight tons with three cranes each at the two largest holds--the second and the fourth).

When there is no danger of collision with the neighboring crane, the cranes can work with additional reaching and turning movements.

The specifications of the crane, prepared in two alternatives, are as follows:

Unchanging lifting capacity--3 tons
Asymmetrical reach 23/21 meters (for the alternative with screw propulsion of reach)
Lowest reach--7.5 meters
Width of the gantry--14.3 meters
Height of raising above head of traveling rail--28.0 meters
Height of lowering below head of traveling rail-10.0 meters
Speed of lifting--60 meters per minute
Average speed of the horizontal movement of the hook--150 meters per minute
Speed of rotation--two rotations per minute
Speed of gantry travel--20 meters per minute
Power of reach-changing engine--22/30 kilowatts per horsepower
Power of rotation engine--9.3/13 kilowatts per horsepower
Power of traveling engines--2 x 5.2/7 kilowatts per horsepower
The engines with a total power of 79.9 kilowatts receive variable current of 380 volts.
Total weight of crane--85 tons, including 33 tons of ballast and counter weights
Greatest stress on wheel--31 tons

The crane was designed in two alternatives, one of which has a screw propulsion for the change in reach while the other uses a toothed mechanism.

The rotating part of the crane consists of a support placed ona pillar, on which the tower and the base of the arms are located. Around the support is the machine chamber containing the lift of the rotating mechanism and the electric installations. The cabin of the operator is located in the front part of the support.

The horizontal movement of the hook during change in reach was attained through a compensating disk. The difference in

height, throughout the distance traveled, between the extreme positions of the arm does not exceed 0.5 percent. The specific set-up of the side-thrust crane makes it possible to balance the arm very precisely with the aid of block counterweight.

The incline of the axis of rotation of the arm is 11 degrees, which results in a flat arch of the ellipse along which the hook is traveling. The "arrow" of the arch is 2.4 meters.

The external pillar construction of the crane permits a safe entry from the gantry ot the machine chamber through an opening cut in the pillar.

The advantages of the design are as follows:

1) a comparatively low weight of the rotating part (35 tons;
2) a comparatively small radius of the circumference (obrys) of construction (3.7 tons;
3) easy assembly of individual components (tower, machine chamber, arm, cabin);
4) considerable durability of rotating elements (easily accessible bearings);
5) safe access to the machine chamber and operator's cabin during both rest and operation.

The gantry of the crane is made of soldered sheet metal. Its individual part will be joined by screws and rivets at the assembling site and then will be placed on the quai by a floating crane.

The following was attained by the application of a three-legged gantry:

1) certainty of stess calculations;
2) increase of the area within the range of the hook;
3) smooth surface of the land-side track (anchoring tongs unnecesssary), which at the same time facilitates possible crossing with railroad track;
4) good visibility from the cabin;
5) ease of production and assembly;
6) adaptation of the crane for easy work on arched tracks.

The duration of a theoretical cycle, which corresponds (in work with a conventional crane to a change in reach of 17 to 7

meters, a rotation of 150 degrees, and again a change in reach from 7 to 17 meters, was calculated at 68 seconds. This corresponds to 53 cycles per hour.

The cost of the crane will be about 2.2 million zlotys with serial production. The assumed lifespan of the construction is about 25 to 30 years, and that of the mechanisms about 10,000 hours of work.

The model of the crane, together with a model of a conventional type crane also designed by BPBM, was demonstrated by the Polish delegation during a recent conference of the Council of Mutual Economic Aid in Leningrad (compare TGM, No 10, 1959) and later, at the request of the organizers, it was shipped to and demonstrated at the Polish Industrial Exhibition in Moscow.

New Hungarian Cranes

The Receiving Commission of the port of Gdynia visited Hungary in August and September in order to make operational and technical tests on two general cargo cranes slated for the Rumunskie quai in Gdynia. The contract concluded with the Hungarian "Nikex" Import and Export Center concerns the construction of 14 cranes, eight of which constitute the equivalent of 10 cranes of the so-called C type, which were returned to the supplier because of designing and execution errors. It should be recalled here that Hungarian cranes of the so-called A type, after some changes, are operating satisfactority in the port of Gdynia.

The cranes contracted for have modern specifications and will cooperate with the assembly of warehouses 20 and 21, the latter being the most modern general cargo warehouse in Polish ports.

The specifications of the crane are as follows:

1) Lifting capacity--3 tons
2) Maximum and minimum reach--25 and 7.5 meters respectively
3) Height of raising above head of rail--25 meters
4) Height of raising below head of rail--10 meters
5) Width of the gantry--6 meters

6) Speed of lifting--60 meters per minute
7) Speed of change in reach--60 meters per minute
8) Speed of travel--30 meters per minute
9) Maximum stress on gantry wheel--22 tons
10) Speed of rotation--1.6 rotations per minute
11) Weight of crane--73.6 tons.

The provisions of the DIN 120 norm and those connected with it were used in the construction of the crane. The crane is of soldered construction with rivet joints used only to facilitate assembly and transport. It consists of two basic parts: the gantry and the rotating part, including the rotating pillar. Thanks to this solution, a compact construction was attained, which will permit a high density of cranes in fast servicing of ships. The accepted principle for mechanisms was the block construction, characterized by considerably operational and repair advantages. In order to further improve the work of the crane--apart from the safeguards used previously in Polish ports--automatic circuit breakers in case the rope drops from the roll and in case the lifting capacity is exceeded,, are being introduced. Also, the engine of the lift is equipped with a signal giving a warning when the safe number of rotations in lowering is exceeded.

The crane is a thrust crane and the weight of the arm is almost completely balanced. The crane receives its power supply through a flexible cable and a switch; the operation of the cable roller is safeguarded by proper circuit breakers. The cabin of the operator ensures good visibility of both the load and the place of work.

The cranes are constructed by the plants of "Wilhelm Pieck" Vaggon es Gepgyar in Gyor. The cope of tests provided for the following:

1) Statistical [sic; static?] test of over-burdening: 4.5 tons--that is, 150 percent of the lifting capacity.
2) Dynamic test of overburdening the crane at 3.75 tons--that is, 125 percent of lifting capacity, at which the operation of all mechanisms was tested.
3) Four-hour operational test of the crane with a 3-ton load.
4) Measurement of working speeds and tests of the specifications of the lift.
5) Investigation of the geometrical characteristics of the crane, including an investigation of the course traveled by the load.

6) Investigation of effectiveness of circuit breakers and warning signals.
7) Check of the quality of construction and mechanisms after the tests.

All these tests and investigations had positive results, and the shortcomings of execution and designing nature observed during the tests were eliminated. Among the interesting results, the following deserve attention:

1) The measurement of productivity during operational tests showed the execution of 37 theoretical cycles as against 35 specified in the contract.
2) The automatic circuit breaker, when exceeding lifting capacity, showed reaction to regulation within about 10 percent.
3) The signal of exceeding the speed of lowering worked correctly.
4) The work of the mechanism of change in reach was very smooth and quiet.

As of the middle of September, components of these cranes have been transported to the port of Gdynia, where, after being assembled, they will be subjected to a 200-hour working test and to final receipt. Three cranes are to start operation this year.

1291

RUMANIA

Production Achievements in Chemical Fertilizers

[This is a translation of excerpts from an article by A. Constantinescu in Revistă de Chimie, Vol X, No 5, May 1959, Bucharest, pages 252-255; CSO: 3380-N/a]

Before the nationaization of the industries, the production of fertilizers in 1948 rose to 179 tons per year in terms of equivalent active substance. After the nationalization, the rate of fertilizer production increase was as follows:

Rate of Growth of Fertilizer Production
(in equivalent amount of nutritive elements)

1950	1951	1954	1955	1956	1957	1958
649	1,232	7,237	10,745	12,696	18,225	30,400

The rate of growth of our fertilizer industry in the next ten to fifteen years will bring our per-hectare fertilizer consumption up to the level of the agriculturally advanced countries--that is, 230 kilograms per hectare of nitrogenous fertilizers and 116 kilograms per hectare of phosphoric ones, or 70 kilograms per hectare of nitrogen and approximately 27 kilograms per hectare of P_2O_5.

* * *

Nitrogenous Fertilizers. The role played by nitrogenous fertilizers in increasing the harvest necessitates the establishment of large fertilizer factories for this type. The Party and government, in their concern for the development of our agriculture, have given and continue to give all support to our nitrogenous fertilizer chemical industry, so that it will be able to fulfill not only the tasks assigned but also create a possibility for export.

The nitrogenous fertilizer production for the current year will be 10,039 tons expressed in active deliverable substances in the form of Nitrolime [calcium cyanamide], ammonium nitrate, and ammonium sulfate.

Aside from the currently existing units, a nitrogenous fertilizer section with an annual capacity of 100,000 tons of ammonium nitrate will be placed into operation, and for 1961 the placing into operation of the largest nitrogenous fertilizer unit with an annual production capacity of 210,000 tons is planned.

Nitrolime is delivered in granulated form and the ammonium nitrate in crystalline form and treated with amaranth, which to a large extent eliminates agglomeration.

In order to facilitate transportation and handling by the consumer, the ammonium nitrate is delivered in sacks, and the Nitrolime in sacks or in bulk as requested by the consumers.

Phosphoric Fertilizers. Our phosphoric fertilizer industry has shown a rapid development.

At the present time our country has three units for manufacturing superphospate, with a [total] annual production of 43,600 tons of P_2O_5.

At the "Petru Poni" Works, all the superphosphate will be granulated.

The granulating installation has already been put into operation. The superphosphate section was also supplied with the necessary installations for ammonization, to give a drier final product of superior quality, devoid of free acidity, and containing 2 to 3 percent of nitrogen in addition to the phosphorus.

In the course of this quarter, the superphosphate section of USAS was placed into operation and will yield a product of good quality containing 18 percent P_2O_5.

For the fourth quarter of this year, it is planned to put into operation the installation for the granulation of superphosphate with a capacity of 50,000 tons.

Granulated superphosphate is treated with carbonate, especially with apatite, and therefore does not agglomerate, which fact gr atly facilitates its handling and machanical use.

The superphosphate section at the Karl Marx Chemical Combine operates with improvised installations, gives a product with approximately 16 percent P_2O_5, and does not have granulation installations. When the "Petru Poni" and the USAS plants cover the production plans, the section at the Karl Marx Chemical Combine will be taken out of operation. In the course of this year a part of the granulated superphosphate will be delivered in sacks.

Potassium Fertilizers. At present the use of potassium fertilizers is not widespread in our country; whatever amount is used comes from imports. The outlook for manufacturing and consumption is encouraging, however, as will be seen later.

In 1958 all fertilizer plants struggled to fulfill and surpass the production plan relating to cost reduction and increased labor productivity.

The following have surpassed the production plan: the I.V. Stalin Chemical Combine, by 20.7 percent; the No 1 Chemical Combine, by 16.5 percent; and the Karl Marx Chemical Combine, by 11.2 percent.

The problem of the cost of fertilizers in general and of nitrogenous fertilizers in particular will be attacked radically through placing into operation the large-capacity units mentioned above, which will allow us to reach the world price level.

Although the quality of fertilizers has improved considerably, there are still shortcomings in this respect. For example, they do not always give the same analysis. However, the tendency is toward a quality equalling that of products manufactured in countries with advanced traditions and technologies.

The behavior of the fertilizers under prolonged storage is not ideal; some of the lots agglomerate after 4 to 5 months of storage, and the packaging used is not sufficiently resistant to the action of physical and chemical agents.

These defects will be eliminated in time--i.e., when the fertilizers will be treated and granulated.

Measures for the Future Development of the Fertilizer Industry

The support given by the Party and government to the fertilizer industry has contributed to the fairly rapid development of our fertilizer industry. Nevertheless, the quantities produced are not sufficient to cover the current requirements and especially the future requirements of the country. Similarly, the variety of fertilizers is not great enough to correspond to the great variations in arable soils. The Party and givernment, in their concern for the welfare of the working people, continue to accord the greatest attention to the long-range development of our fertilizer industry. Thus, of the total of 17.4 billion lei envisaged in the 1959 budget for industrial investment, over 20 percent is allocated for the development of the chemical industry. The investment allocations in the chemical industry for 1959 are 50 percent higher than those for 1958.

Of the funds allocated for investments, a large part goes to the fertilizer industry.

Thus it is planned to place the following units into operation in the near future for the manufacturing of fertilizers:

Phosphoric Fertilizers

1. At USAS, the development of the current superphosphate line will permit the productive capacity in the first quarter of 1960 to rise to 37,800 tons per year in terms of active substance. The entire production will be granulated.

2. On the basis of the large reserves of complex minerals found at Lesul Ursului, a powerful nonferrous metallurgical industry, which will also produce sulphuric acid, will be developed there by 1965. The sulphuric acid produced there will be used on the spot in the manufacture of concentrated (triple) superphosphate. This contains approximately 48 percent P_2O_5 and is three times more concentrated than

simple superphosphate, which contains 16 to 18 percent P_2O_5.

The installations planned for construction are:

a) Section I for concentrated superphosphate, with a capacity of 48,000 tons per year in terms of active substance, planned to start production in the second quarter of 1963.

b) Section II, for concentrated superphosphate, with the same capacity, planned to start productions in the second quarter of 1964.

3. The construction of a thermophosphate plant, 26 percent P_2O_5, is planned at the No 2 Soda Plant, with a capacity of 26,000 tons per year in terms of active substance. It is planned to place this unit into operation in the first quarter of 1965.

Nitrogenous Fertilizers. The nitrogenous fertilizer industry will be developed intensively because of the importance given to it on the basis of the availability of the raw material--namely, methane gas.

Aside from the ammonium nitrate section at the No 1 Chemical Combine with a capacity of 100,000 tons per year, and the Combine for the Chemical Transformation of Methane at Roznov, with a capacity of 210,000 tons per year, which are planned to start production in the first quarter of 1961, other industrial objectives are foreseen in the plan for the development of the chemical industry.

Potassium Fertilizers. Geological investigation and exploratory work for the identification of potassium salt deposits have been made for several years within the framework of our ministry.

So far one deposit has been identified in the Tg. Ocna area, and there are promising indications for the identification of another deposit. With a view to their exploitation for the 1959 plan, the following was undertaken:

1. Geological explorations, through mining operations as well as explorations through drilling and boring for the new deposits.

2. The construction of a semi-industrial station for the preparation of the minerals, with a view to obtaining concentrated potassium salts with 40 percent K_2O.

[a] The construction of a semi-industrial installation with an annual capacity of 1,500 tons will begin.

3. In the long-range plan still being discussed at the CSP [Comitetul de Stat al Planificarii; State Planning Commission], the following mining explorations and sections for the processing of potassium salts are planned for completion:

[a] Section I for potassium salts, with a capacity of 40,000 tons of 40 percent K_2O per year, to be placed into operation during the second quarter of 1963;

[b] Section II for potassium salts, with a capacity of 40,000 tons of 40 percent K_2O per year, to be placed into operation in the second quarter of 1964;

[c] Section III for potassium salts, with a capacity of 80,000 tons of 40 percent K_2O per year, to be placed into operation in the second quarter of 1965.

The production capacity of the chemical fertilizer plants in the long-range plan for 1965 includes: 1,030,000 tons of phosphoric fertilizers (18 percent P_2O_5); 1,100,000 tons of nitrogenous fertilizers (35 percent nitrogen), and 160,000 tons of potassium fertilizers (40 percent K_2O).

Comparative Table
on Productive Capacity for Chemical Fertilizers
in Tons of Active Substance for 1959 and 1965,
as Foreseen in the Long-Range Plans

Type	Capacity in Tons per Year		Increase in Production in
Type	1959	1965	1965 over 1959
A. Phosphoric fertilizers (with 18 percent P_2O_5)	43,596	185,400	4.25 times
B. Nitrogenous fertilizers (with 35 percent nitrogen)	10,178	385,000	37.82 times

[Table continued]

C. Potassium fertilizers (with 40 percent K_2O)	-	64,000	not made in 1959
Total	53,774	634,400	11.79 times

With respect to the construction of the new combines and the development of the existing units, the plans foresee the introduction of advanced working methods in the development of the technological process, complete mechanization, at least partial if not complete automation, and the assurance of labor safety and hygiene.

Planned Types of Fertilizers

Nitrogenous Fertilizers. The tables show that interest in extending the types of fertilizers is permanent.

The large-scale use of urea, Nitrophos, and ammonium sulfate will be possible in the near future.

Ammonium nitrate neutralized with dolomite will also have to be taken into consideration as a new type of nitrogenous fertilizer and thus studied and experimented with. This is a very efficaceous fertilizer for lightly sandy or sandy and clayey soils which also need magnesium as fertilizer.

Another type of fertilizer, in which unfortunately there is little interest, are liquid fertilizers.

The efficacy of these fertilizers in comparison with the regular solid fertilizers is no longer questionable in the light of experiments made abroad.

Sometimes liquid fertilizers give even better results because they make the nutritional elements more easily available to the plants and because they contain a larger proportion of nitrogen compared to phosphorus and potassium (naturally in the case of complex liquid fertilizers).

Owing to the fact that the production of liquid nitrogenous fertilizers--ammonia liquid or ammonical solutions--will require considerably smaller investments per unit of nitrogen produced and may be organized relatively quickly, these fertilizers should be used on a large scale in our agriculture.

Liquid nitrogenous fertilizers also have the advantage that all handling and spreading and spreading operations are completely mechanized.

* * *

Solid Complex Fertilizers. This type of fertilizer, which is very efficaceous and advantageous from every point of view, is used very little by us and where it is used it is obtained as a mixture made under primitive conditions, assuring neither uniformity of the product nor economic operation.

The advantages of using triple complex fertilizers and eventually some containing elements other than nitrogen, phosphorus, and potassium, are:

[1] assured efficacy equal and sometimessuperior to that of simple fertilizers;

[2] superior physical and mechanical properties, facilitating handling, transportation, and storage;

[3] economy, from the point of view of both transportation and incorporation into the soil, since they give the plants all three nutritional elements needed in a single operation. The great diversity of our arable soils also indicates the great variety of types of complex fertilizers.

The data available in the literature and the experience of other countries nevertheless show that a variety of 10 to 12 types is sufficient.

The problem of fertilizers with microelements, which will be used more and more, should also be mentioned. We have residues of boron, manganese, copper, zinc, etc. In collaberation with research institutes as well as in field work, the utilization of these elements in our industrial practice and application must be introduced systematically, so that this year we should have the results and the direction to be taken in the development of our chemical industry.

In order to establish judiciously the types of fertilizers which our chemical industry should produce, it is absolutely necessary that the charting of agricultural terrains be done correctly and speedily. This will at the same time allow the rational use of the fertilizers.

Storage

With respect to the problem of fertilizer storage, the Ministry of Petroleum Chemistry has a well-established opinion which it upheld in the discussions of two years ago and which it has maintained.

This opinion is that the responsibility for fertilizer storage lies with distribution and agricultural consuming organizations.

Owing to the massive daily production of fertilizers by the plants--300 to 320 tons daily--it is impossible to build at the producing places storage areas that will accommodate more than 3,000 to 4,500 tons--i.e., capable of holding the production of 10 to 15 days--both because of the cost of the storage facilities and because of lack of space.

The difficulty is even greater in the case of superphosphate, which requires two storage areas, one for aging and the other for the finished product.

* * *

In conclusion, the Ministry of Petroleum and Chemistry proposes the inclusion of the following desiderata in the resolutions of the meeting:

1. To establish an operational work collective composed of five comrades, two from chemistry and two from agriculture, under the leadership of a comrade from the Ministry of Agriculture and Forestry with the rank of Adjunct Minister or Secretary General, which should discuss the problems common to agriculture and chemistry and propose [solutions for] them to the two leaderships.

2. In order to achieve effective publicity, the two ministers should collaborate in the elaboration of instructions or common agenda, which should include technical data on fertilizers and insecto-fungicides (characteristics, analyses, instructions for use, obtainable production increases, etc.).

The instructions should be completed and revised every two years. Similarly, the establishment of a practical guide elaborated through the same collaboration is necessary.

3. In the specialty journals of chemistry and agriculture, special columns should be run to deal with agrochemical problems, thereby improving reciprocal [exchange of] information.

4. Exchange of publications on new developments should be more intense with a view to the same reciprocal exchange.

5. The ASIT [Asociatia Stiintifica a Inginerilor si Tehnicienilor; Scientific Association of Engineers and Technicians] and the circles in chemistry and agriculture--both central and local--should collaborate more closely.

6. In the large collectivized agricultural areas, joint local meetings should be organized at the state farms by the Ministry of Agriculture and Forestry.

7. In 1959 engineer and worker groups from the fertilizer industry should visit the neighboring collective and state farms, and agricultural workers should visit industries.

8. The comrades from agriculture should also be invited to the annual lecture meetings held at the fertilizer combines.

9. At the end of every agricultural campaign, a joint report should be prepared on the agrochemical result obtained in the respective campaign.

1024

RUMANIA

Achievements in the Use of Chemical Fertilizers

[This is a translation of an article by M. Stancu in Revista de Chimie, Vol 10, No 5, May 1959, Bucharest, pages 256-257; CSO: 3380-N/b]

The transformation of our agriculture along socialist lines involved changing not only the production relationships but also the means of production, socialist agriculture presupposing a whole series of modern working methods, of which mechanization and "chemicalization" are the most important.

In the light of the above, the results obtained through the application of mineral fertilizers will be treated with emphasis on the low level of harvests received in the country under the bourgeois-landlord regime, when only 11,000 tons of mineral fertilizers were used in the entire country (1938). In comparison with this figure, the quantities of mineral fertilizers produced for the first time in our country and currently used is growing from year to year, 28 times as large a quantity being planned for 1959. But even with this steep climb, the production of mineral fertilizers in our country covers only 10 percent of the continually increasing requirements of agriculture for the near future.

In terms of the fertilized areas, this denotes a considerable increase, since the area being treated with mineral fertilizers is 2.17 times larger in 1959 than in 1957.

During 1957-1958 the types of mineral fertilizers consisted of about 60 percent phosphate fertilizers, 30 to 33 percent nitrogenous fertilizers, and 5 to 9 percent potassium fertilizers, with the largest part being used in the state farm units (75 percent of the phosphate fertilizers, 50 percent of the nitrogenous fertilizers, and 35 percent of the potassium fertilizers). Similarly, sizable quantities were used by the cooperative units of agriculture.

The results obtained through the use of mineral fertilizers were shown by the increases in yield achieved by the socialist agricultural units and on the experimental fields of the research stations; these varied in terms of the region, the type of soil, and the plants to which the fertilizers were applied. In this sense, the following results were obtained:

1. In Timisoara Regiune an average harvest of 5,020 kilograms of wheat per hectare was achieved in 1957 through the application of fertilizers and other agrotechnical measures on an area of 109 hectares.

2. Compared with an average yield of 13,000 kilograms of sugar beet roots, through the application of mineral fertilizers during the vegetation period ($N_{60}: P_{30}: K_{60}$), the following increases in yield were obtained: 10,038 kilograms per hectare in the Cluj Regiune, 9,366 kilograms per hectare in Timisoara Regiune, and an average of 39,719 kilograms per hectare on an area of 63 hectares in Oradea Regiune, and an average of 35,100 kilograms per hectare in Arad Raion on an area of 25 hectares.

3. At present the average yield of sunflower seeds is still very low compared with the actual possibilities, varying in 1957 from 840 kilograms per hectare in the private sector to 1,010 kilograms per hectare in the state agricultural farms. Through the use of 265 kilograms of superphosphate per hectare incorporated into the basic plowing in the fall, an average increase in yield of 430 kilograms per hectare was obtained in Constanta Regiune.

4. The application of mineral fertilizers on areas sown in wheat led to an average yield of 1,975 kilograms per hectare in 1958 in Bucharest Regiune as compared to the unfertilized areas, where the wheat harvest was only 1,550 kilograms per hectare, and in Timisoara Regiune a yield of 2,100 kilograms per hectare was obtained on an area of 1,200 hectares in comparison with 1,500 kilograms per hectare on an area of 640 unfertilized hectares.

5. In Bucharest Regiune, the application of 200 kilograms of superphosphate and 100 kilograms of ammonium nitrate per hectare resulted in an average harvest of 2,900 kilograms of corn kernels per hectare as compared to 2,080 kilograms per hectare obtained on the unfertilized areas.

6. In the steppe area, granulated superphosphate proved to be more efficient than thepulverized type in the cultivation of wheat.

7. Through the application of 10 tons of lime, 20 tons of manure, and moderate quantities of mineral fertilizers (50 kilograms of ammonium nitrate, 50 kilograms of superphosphate and 50 kilograms of potassium salt), an increase in yield of 1,954 kilograms of wheat per hectare and a concomitant 50-percent decrease in the cost was obtained on the experimental field of the Agronomic Instituteof Timisoara in Caran Cebes Raion.

8. The same institute obtained on the same soil an increase of 1,137 kilograms of wheat per hectare through the application of one ton of lime, 10 tons of manure, 200 kilograms of ammonium nitrate, 200 kilograms of superphosphate, and 200 kilograms of potassium sulfate per hectare.

9. Similarly, by fertilizing some alluvial podzol soils with 33 kilograms of N_2, 24 kilograms of P_2O_5, and 19 kilograms of K_2O, an increase of 17,961 kilograms of sugar beet roots or 2,922 kilograms of sugar per hectare was obtained.

10. Also in the cultivation of irrigated sigar beets, the Agronomic Institute of Bucharest received an increase of 23 to 32 percent, using dosages of 60 kilograms of N_2 + 36 kilograms of P_2O_5 and 80 kilograms of K_2O per hectare.

11. Experimental data of the viti-pomicultural sector show substantial harvest increases. Thus:

a) In the Ragasani area, increases of 2,050 kilograms of grapes per hectare were obtained through the application of 100 kilograms of N_2, 150 kilograms of P_2O_5, and 50 kilograms of K_2O per hectare.

b) In the Odobesti area, the application to a very rich soil of 150 kilograms of N_2, 250 kilograms of P_2O_5, and 150 kilograms of K_2O resulted in an increase of 3,450 kilograms of grapes per hectare.

c) In the Valea Calugareasca area, the application of 120 kilograms of N_2, 180 kilograms of P_2O_5, 120 kilograms of K_2O and 40 tons of manure per hectare resulted in a yield increase of 2,200 kilograms of grapes per hectare.

d) In Hunedoara Regiune, the application of 120 kilograms of N_2, 100 kilograms of P_2O_5, 80 kilograms of K_2O, and 5 tons of manure per hectare resulted in an increase in yield of 9,800 kilograms of prunes per hectare as compared to the nonfertilized control area.

e) In apple orchards, the application to the roots of each tree of 3 kilograms of superphosphate, 2 kilograms of potassium salt, and 1.5 to 2.5 kolograms of ammonium nitrate resulted in an increase in yield of 4,500 to 9,000 kilograms per hectare.

f) Using the same fertilizer dosage, apple harvests varying between 5,600 and 11,200 kilograms per hectare and prune harvests of 7,370 kilograms per hectare were obtained in 1957 in Pitesti Regiune.

12. In the cultivation of legumes, the application of mineral fertilizers led to substantial harvest increases. Thus:

a) In Buzau Regiune, the application to the cultivation of tomatoes (Pritchord type) of 65 kilograms of N_2, 120 kilograms of P_2O_5, 75 kilograms of K_2O, and 10 tons of manure per hectare resulted in a yield increase of 71,529 kilograms per hectare in 1958.

b) In Bucharest Regiune, a 33 percent yield increase in the cultivation of tomatoes (same type) was achieved through the application of 10 tons of manure mixed with 350 kilograms of superphosphate as basic fertilizer and the supplementary application of 65 kilograms of N_2, 75 kilograms of P_2O_5, and 75 kilograms of K_2O per hectare.

c) In the cultivation of "fat" peppers (111 B type), harvest increases of 50 percent were obtained through the application of 40 tons of manure per hectare as basic fertilizer and the supplementary application of 44 kilograms of N_2, 57 kilograms of P_2O_5, and 80 kilograms of K_2O.

In addition we must mention a series of deficiencies and difficulties appearing in the new work for the chemical transformation and the application of fertilizers in Rumania; in this sense it is recommended that:

[a] Without neglecting the use of manure and other organic fertilizers, the application of mineral fertilizers must

constitute one of the principal means of increasing the yield of the socialist agricultural units.

[b] Mineral fertilizers must be applied in a differentiated manner, taking into consideration the condition of the soil and the plants and the experience gained in this field up to now.

[c] Waste of fertilizer must be eliminated by eliminating haphazard methods of use.

[d] The fertilizer-producing enterprises must deliver high quality products at the lowest possible price.

[e] For the elimination of fertilizer losses, it is necessary that the machine-building industry produce aggregates for spreading of maximum efficiency.

[f] The types of fertilizers, insecto-fungicides, and pesticides must be increased to correspond to the varied requirements of our country.

[g] The fertilizer producing and consuming units must solve without delay the problem of packaging and storing fertilizers in order to prevent losses from these causes.

[h] Fertilizers must be introduced and used without delay by training an ever larger number of specialists and by active propaganda work.

1024

RUMANIA

Research on New Types of Fertilizers

[This is a translation of an article by E. Ionescu in Revista de Chimie, Vol X, No 5, May 1959, Bucharest, pages 263-264; CSO: 3380-N/c]

Within the framework of the Chemical Research Institute (ICECHIM) of the MIPC [Ministerul Industriei Petrolului si a Chimiei; Ministry of Petroleum and Chemical Industry], a series of types of fertilizers were prepared in laboratory, pilot, or semi-industrial phases and then tested in agricultural experimental lots.

1. Alkaline Thermophosphates

a) Research Phase: pilot (total obtained, 12 tons)

b) Technological Process: mixing of the Kola apatite concentrate with quartz sand and sodium carbonate; granulation of the mixture through pelletizing; calcination of the granules at 1,150 to 1,200 degrees centigrade in rotating furnaces; and milling of the clinker.

c) Specific Consumption: Kila apatite concentrated, 0.835 tons per ton; calcinated soda, 0.292 tons per ton; quartz sand, 0.092 tons per ton; methane gas, 180 cubic meters per ton; electric power, 115 kilowatt hours per ton.

d) Composition of the Product: 30 percent assimilable (solutlbe in citric acid) P_2O_5; 10.5 percent SiO_2; 16.5 percent Na_2O; 39 percent CaO; 2 percent F; 2 percent R_2O_3.

Results: the agrochemical properties were confirmed; the absence of hygroscopic and agglomerating tendencies allowed machine spreading.

2. Magnesium Thermophosphates

a) Research Phase: semi-industrial (total obtained, 15 tons)

b) Technological Process: mixing of the Kola apatite concentrare with serpentine, sand, and ground pyrite ashes; pelletizing of the mixture with the addition of sodium silicate as a binder; melting of the pelletized mixture in a Piltz-type oven at 1,400 to 1,450 degrees centigrade; sudden cooling of the melt in water; and drying and grinding of the product.

c) Specific Consumption: Kola apatite concentrate, 0.530 tons per ton; serpentine, 0.380 tons per ton; sand, 0.110 tons per ton; pyrite ash, 0.096 tons per ton; sodium silicate, 0.070 tons per ton; coke, 0.200 tons per ton; electric power, 100 kilowatt hours per ton.

d) Composition of the product; 19 percent total P_2O_5; 17.30 percent assimilable (soluble in citric acid) P_2O_5; 26.80 percent SiO_2; 12.00 percent MgO; 26.30 percent CaO; 6 percent Fe_2O_3; 1.50 percent FeO; 1.15 percent metallic Fe; 1.14 percent FeS; 2.45 percent Al_2O_3; trace Na_2O; 0.16 percent F.

e) Results; during the first tests, the product, which is in the course of experimentation, showed increases in harvest which were superior in comparison with those achieved with alkaline thermophosphates; the absence of hygroscopic and agglomerating tendencies make it suitable for machine application.

3. Defluorinated Thermophosphates

a) Research Phase: pilot

b) Technological Process: calcination at high temperatures (1,160 to 1.180 degrees centigrade) of granules formed from various mixtures of raw materials, and grinding of the clinker.

c) Specific Consumption for Various Mixtures:

	Mixture I	Mixture II	Mixture III
Kola apatite concentrate, tons per ton	0.567	1.000	-
Quartz sand, tons per ton	0.513	0.030	0.170
Phosphorite, tons per ton	-	-	1.010
Methane gas, cubic meters per ton	180	300	300
Electric power, kilowatt hours per ton	-	130	-

d) Composition of Product for Various Mixtures:

	Mixture I	Mixture II	Mixture III
	(in percent)		
P_2O_5 total	21.0	27.0	29.0
P_2O_5 assimilable	20.5	34.0	28.0
SiO_2	45.0	6.3	6.5
CaO	29.0	50.0	52.0
R_2O_3	2.0	1.9	0.95
F	0.1	0.15	0.15

e) Results: product is in course of experimentation.

4. Precipitate (Dicalcium Phosphate)

a) Research Phase: first variation--laboratory; second variation--pilot.

b) Technological Process: first variation--"solubilization" of natural phosphates in hydrochloric acid; elimination of fluorine from the solution; neutralization of phosphoric acid through the addition of lime until the formation of dicalcium phosphate; filtration; and washing and drying of the precipitate. Second variation--dissolution in water of the monocalcium phosphate from the superphosphate; separation of the insoluble phosphogypsum; precipitation of the dicalcium phosphate with lime wash without previous elimination of fluorine; filtration and drying of the precipitate.

c) Specific Consumption: for the first variation--superphosphate with 18 percent P_2O_5, 2.25 tons per ton; burned lime, 0.2 tons per ton; technical sodium sulfate, 0.8 tons per ton; electric power, 60 kilowatt hours per ton; methane gas, 50 cubic meters per ton.

d) Composition of the Product: for the second variation--38 percent total P_2O_5; 37 percent assimilable P_2O_5; 32 percent CaO; 2 percent R_2O_3; 20 percent crystallization water; 5 percent humidity; 0.03 percent F; 0.006 percent As.

e) Results: nonhygroscopic product, insoluble in water, soluble in citrate; when manufactured from As-free superphosphate, it may be used for fattening animals, and it is suitable for machine application.

5. Mixed Fertilizers (Salt Mixtures with N:P:K)

a) Research Phase: semi-industrial

b) Technological Process: neutralization of the free acidity of the superphosphate with dolomite powder and mixing of the three components in a previously established proportion in a ball-bearing mill, so that monogeneous mixtures with a granulation of 0.25 millimeters will result.

The relationship between N_2: P_2O_5:K_2O as previously established: mixture 1 = 1:1:1; mixture 2 = 1:1:0.5; mixture 3 = 2:1:0.5; mixture 4 = 2:2:0.5.

c) Specific Consumption: varies in terms of mixtures--ammonium sulfate, 0.350 to 0.550 tons per ton; superphosphate, 0.390 to 0.550 tons per ton; potassium chloride (53 percent K_2O), 0.040 to 0.150 tons per ton; dolomite, 0.008 to 0.012 tons per ton; electric power, 60 kilowatt hours per ton.

d) Composition of the Product--percentage in terms of mixture:

Mixture	N_2	P_2O_5 Total	P_2O_5 Assimilable	K_2O	pH	H_2O
1	7.15	12.40	7.20	7.05	4.7	1.72
2	7.35	13.40	7.90	4.10	4.7	1.56
3	10.80	9.70	6.00	3.20	4.9	2.01
4	8.10	13.80	8.00	2.10	4.6	1.95

e) Results: reduced hygroscopic and agglomerating tendencies; tested for horticulture, pomiculture, and legumiculture in small quantities (one-kilogram packages).

6. Ammoniates

a) Research Phase: laboratory

b) Technological Process: dissolution of ammonium nitrate in ammonia solution or saturation of a concentrated solution of ammonium nitrate (80 percent) with ammonia gas.

c) Specific Consumption for Various Types:

	Type A	Type B
Ammonium nitrate, tons per ton	0.64	0.56
Ammonia gas, tons per ton	0.15	0.26
Water, cubic meters per ton	100	100
Electric power, kilowatt hours per ton	50	50

d) Composition of the Product for the Two Types:

	Type A	Type B
Ammonia, percent	14	25
Ammonium nitrate, percent	64	56
Total nitrogen, percent	34	40
Water, percent	22	17
Vapor pressure at 20 degrees centigrade, atmospheres	0.1	0.82
Crystallization temperature, degrees centigrade	+ 10	- 15

e) Results: illumination of the problem of pressure containers for transportation and storage of anhydrous ammonia and the problem of high agglomeration of ammonium nitrate. Type A is recommended for warm seasons (because of the high crystallization point), and type B for cold seasons (because of the high vapor pressure).

Observations: it may be mentioned that the cost reported for one ton of assimilable P_2O_5 is the lowest in the case of the second variation of defluoridated thermophosphates, the other types being more expensive. Setting the second variation of defluorinated thermophosphates as 100, the following were obtained: defluorinated thermophosphate, third mixture = 114; defluorinated thermophosphates, first mixture = 118; alkaline thermophosphates = 121; magnesium thermophosphates = 204; precipitated = 303.

1024

RUMANIA

Increased Production and Reduced Cost Price at the I. V. Stalin Chemical Combine

[This is a translation of an article by L. Claudian in Revista de Chimie, Vol 10, No 5, May 1959, Bucharest, page 284; CSO: 3380-N/d]

In order to achieve an increased production of fertilizers at the I.V. Stalin Chemical Combine, it was necessary to increase at the same time the capacity of three plants within the framework of the combine--namely, the ammonia plant, the nitric acid plant, and the ammonium nitrate plant.

Difficulties related to finding the most suitable ways appeared in all three cases; the greatest, however, were in connection with the ammonia plant, as a result of both the complexity of processes and installations and the cost of investments.

The solution for the ammonia plant was found through the innovations proposed by Engineers Oliviu Popa and Mircea Constantinescu, which provided for reducing the endothermic character of the conversion reaction through the introduction of air into the reactor tubes and thus allowed the conversion of 50 percent more gas and a corresponding yield.

Tests of the new procedure took place in January 1957. In February the construction operations began, and by May, when the general closing down of the plant for its annual inspection was planned all the equipment not necessitating the dislocation of other operating equipment had been assembled. The erection and installation of the equipment was done during the inspection close-down of the plant.

The increase in capacity was achieved with a minimum of invested funds; this was made possible not only by an attentive examination of each piece of equipment separately and of its most rational use but also through technological changes. Thus sizable investment savings were obtained through the unchanged utilization of the installation for washing synthetic gas to eliminate carbon oxide. For this purpose, washing with lye on a copper formiate base, which

has a much greater capacity for the absorption of carbon oxide, was substituted for washing with cupro-ammoniac lye.

In the case of the nitric acid plant, whose capacity increase was studied by a different group of engineers, solutions with small investments were again found.

Thus, by lowering the circuit resistances, it was possible to achieve a corresponding increase in the capacity of the ventilators in the installation for burning ammonia, thereby bypassing the extremely difficult problem of importing special ventilators. Similarly, by using a low temperature for the cooling water and intensifying the recirculation of the acid, a substantial increase in the absorption capacity in the diwers of the dilute nitric acid installation was achieved. The absorption capacity was further increased through the partial utilization for this purpose of the oxidation towers of the concentrated nitric acid installation, for which the filling of the Raschig rings was increased.

At the ammonium nitrate plant the bottlenecks were pinned down in the neutralization, evaporation, and crystallization phases. To eliminate them, a new neutralizer was assembled, the old one being used as a tampon pot; a second evaporator was installed, and the revolution speed of the crystallization rollers was increased by the replacement of the activating motors; similarly, some of the pipes and armatures in the circuits where the permissible flowing speeds were being exceeded were replaced.

The solutions found and the work carried out yielded the following results:

a) increase in productive capacity as compared to 1955:

	1955	1956	1957
Ammonia plant	100	165	225
Nitric acid plant	100	100	140
Ammonium nitrate plant	100	133	190

b) the dynamics of basic means in comparison with 19555 (or the need for new investment funds):

	1955	1956	1957
Ammonia plant	100	125	151
Nitric acid plant	100	103	104
Ammonium nitrate plant	100	105	109

In conclusion, with a 125-percent production increase in the ammonia plant, 40-percent in the nitric acid plant, and 90-percent in the ammonium nitrate plant, the value of the basic means has correspondingly increased by 51, 4, and 9 percent.

c) The quality of the interm diate or final products in the past two years has not undergone any modifications worthy of mention. The tendency of the ammonium nitrate to agglomerate continued to be combatted by adding amaranth--a method which proved to be of satisfactory efficacy. However, it was not possible so far to deliver a granulated product of suitable quality.

d) In most of the equipment, the utilization indices have shown sizable increases. Thus, in the final burning ovens there was an increase of 36 percent; in the tower for washing the synthetic gas with copper lye, 36 percent; in the elements for burning ammonia, 25 percent; in the concentrators for the ammonium nitrate, 40 percent.

e) In intensifying the processes and in large measure that of the aggregates in the ammonia, nitric acid, and ammonium nitrate plants, no increase was made in the specific consumption of raw materials and of utilities; on the contrary, they show some decrease. Thus the methane gas consumption for ammonia decreased by 1.5 percent; electric power consumption for ammonia, one percent, and consumption of electric power for nitric acid, 2.25 percent.

f) Labor productivity in the ammonia, nitric acid, and ammonium nitrate plants has shown a substantial increase as a result of the increase in productive capacity. Thus in the ammonia factory there was an increase of 15 percent; in the nitric acid plant, 73 percent; and in the ammonium nitrate plant 42 percent.

g) As a result of lowering the consumption indices and sectional expenses, the cost was reduced substantially for both the intermediate products-- ammonia and nitric acid--and for the final product--ammonium nitrate. In comparison with 1955 the following price reductions were shown:

	1955	1956	1957	1958
Ammonia	100	83	71	65
Nitric acid	100	80	66	60
Ammonium nitrate	100	76	66	57

The research work carried out within the framework of the I.V. Stalin Combine was generally geared to the problems raised by the increased capacity of the plants, of obtaining catalyats in the country, and the creation of new products related to the nature of the combine.

In the field of nitrogenous fertilizers, the possibilities for obtaining ammoniates were studied.

Together with the IPROCHIM [Planning Institute for the Chemical Industry] Institute and the SIN [not identified] factory, a new procedure for obtaining nonagglomerating nitrogen through the addition of "NNO" sintamol--a material much cheaper than amaranth--is being tested.

1024

RUMANIA

Achievements in the Mineral Fertilizer Sector of Chemical Combine No 1, 1956-1958

[This is a translation of an article by T. Bota in Revista de Chimie, Vol 10, No 5, May 1959, Bucharest, page 285; CSO: 3380-N/e]

The mineral fertilizer sector directed its activity within the framework of the Chemical Combine No 1 toward two main objectives--finding and testing new nitrogenous fertilizers and following up and improving the production processes in the operating installations with a view to obtaining quality products at the lowest possible cost.

1. Research Activities

In cooperation with the ICECHIM and IPROCHIM research and planning institutes of the chemical industry, the research collective of the combine did some pilot-plant studies on "Nitrofosfat" mixed fertilizer obtained by carbonic procedure with a composition of 18 percent N_2 and 13 percent N_2O_5. Experiments are still being carried out, the results obtained being as yet inconclusive.

At the same time, the injection into the soil of an ammonia liquid and the problem of fertilizers difficult to levigate--specifically the testing of a fertilizer obtained from urea condensed with formaldehyde--were studied.

With reference to the fertilizers difficult to levigate, a type was obtained with 40 percent N_2, of which one third was immediately soluble in water and two thirds were gradually soluble during the vegetation period.

The lack of complete data stems from the fact that the experiments were suspended after a year.

2. Production Activities

At the Chemical Combine No 1, "Nitrocalcar" is being manufactured on an industrial scale according to the following technological process: the limestone is first broken up in a crusher, then in a hammer mill, and finally transformed into powder in a ball-bearing mill. The powder is transported pneumatically by means of snake-type Fuller pumps.

The ammonia liquid is transformed into gaseous ammonia and introduced into a neutralizer where it reacts with nitric acid of 50 percent concentration. The reaction is exothermic, the temperature rising to 100 to 105 degrees centigrade. The NH_4NO_3 [ammonium nitrate] solution obtained has a 60-percent content and is to be concentrated in two steps--namely 65 to 70 percent in Evaporator I and 95 to 96 percent in Evaporator II. The evaporation is done in vacuum.

The 96-percent concentrated ammonium nitrate solution is mixed at 135 degrees centigrade with powdered limestone in a proportion of 60 percent NH_4NO_3 to 40 percent limestone in a snake granulator, yielding nitrolime with an average concentration of 20.5 percent N_2.

The obtained nitrolime is packaged or stored in bulk.

During the technological process a series of difficulties and deficiencies have arisen, some of which have been eliminated, the rest being in the process of being eliminated with continuous attempts to improve the product and lower the cost. In this respect we may cite:

a) A pH meter with automated regulating valves, which will reduce the ammonia losses by reducing consumption in the neutralizer, was installed.

b) The manufacture of nitrolime was mechanized through the utilization of elevators and conveyor belts.

c) The stone is fed into the crusher manually and is transported with Decauville wagonettes, which results in losses, requires a great deal of hand labor, and is therefore costly.

d) To improve the system of unloading the wagonettes, cascading conveyor belts were introduced for the transport of limestone.

e) For packaging the bulk nitrolime, the utilization of rolling-belt installations of great efficiency is being studied by the IPROCHIM branch in Sibiu. By putting this equipment into operation, the problem of shipping large quantities of this product during the period of maximum consumption will be solved.

f) Difficulties were also encountered in obtaining the expressed nitrogen content concentration and the desired granulation. By observing the mode of operation of the granulator, the cooling drum, and the separating funnel, it was observed that the separating funnel did not separate the powder from the granules. In this connection, the vibrating system was modified through the replacement of the lateral arcs with suspended arcs mortised on rubber squeezers; thus the vibrations transmitted to the building were eliminated as the vibrations of the funnel were greatly amplified.

During 1956-1958 complaints were received about the quality of the product.

From the point of view of production costs, we may mention that they are greater than those prevailing on the world market.

The causes leading to this difference stem both from the high price of the ammonia and nitric acid and from the used capacity of the installations, which in some cases operate at only 40 to 50 percent of capacity.

In order to remedy this situation and to produce this fertilizer at the lowest possible cost, it will be necessary to synchronize the factory in all phases of the technological process.

In this sense the following measures are proposed:

a) the installation of a crusher, a hammer-mill, and a reserve ventilator at the stone mill;
b) the doubling of the heating unit in the second state of evaporation;
c) the installation of a second granulator in the granulation of the nitrolime;
d) setting into operation a crystallization station for technical ammonium nitrate.

Through the realization of these technical-organizational measures, the production of the factory will be increased by 30 percent compared to its present installed capacity, which will lead to a considerable reduction in costs--about 50 percent according to the first estimates.

The increase in nitrolime production capacity is, however, influenced by its conditions, and from this point of view agriculture will have to recognize its advantages along both technical and economic lines.

1024

RUMANIA

Manufacture of Superphosphates from Imported Phosphorites at the "Karl Marx" Chemical Combine

[This is a translation of an article by Gh. Macavei in Revista de Chimie, Vol 10, No 5, May 1959, Bucharest, pages 286-288; CSO: 3380-N/f]

In the manufacture of superphosphate at the "Karl Marx" Chemical Combine, the discontinuous process is used.

The installation consists of the following main equipment:

[1] A Hoverman-type mixer together with apparatuses for measuring out sulfuric acid and natural calcium phosphates;

[2] A reaction tunnel in which wagonettes circulate, as well as auxiliary equipment such as mechanical trolleys and exhaust (ventilator) system;

[3] Installations for feeding the acid (centrifugal pumps) and phosphorite or apatite concentrates (moving conveyor belts).

The installation is built for operation with apatite and, when the raw material was changed to phosphorite from the Asiatic Near East, the manufacturing parameters had to be modified, taking into consideration the character of the natural phosphates and of the manufacturing system.

In order to establish the new operating conditions, a series of laboratory tests and industrial tests was carried out. Although these were limited in number because of the urgent need to begin production, they were sufficiently conclusive for determining the technological parameters.

A check of the specialty literature shows that the Asiatic Near East phosphorites come from recently discovered deposits forming a part of the category of sedimentary formations with stratified structure (6 to 8 meters in thickness). In their chemical composition they are like some of the phosphorites of North Africa.

Table I gives the chemical composition of some phosphorites from North Africa together with the composition of the Asiatic phosphorites, phosphorites from Florida, and apatite concentrates from Kola.

Table I
Phorphorite Ores

Components	Apatite from Kola	Asiatic Near East	Gafsa, Africa	Morrocco Africa	Constantine Africa	Fla. USA
H_2O combined with organic matters	0.71	Not analyzed	3.86	2.41	3.94	3.02
P_2O_5	38.69	27.10	1.86	34.03	25.71	33.39
SO_2	0.27	1.86	2.80	1.68	2.30	0.93
CO_2		10.00	5.65	3.24	10.16	2.78
SiO_2	3.48	2.71	2.86	2.50	4.26	5.83
Fe_2O_3	0.72	0.27	0.35	0.37	0.40	1.27
Al_2O_3	1.52		0.87	0.53	0.82	1.07
CaO	52.10	51.01	49.47	52.09	47.10	48.79
MgO	0.08	Not analyzed	0.57	0.22	2.14	0.40
Na_2O	0.32	3.12	1.88	0.72	1.20	0.30
K_2O	0.13	Not analyzed	0.09	0.07	0.05	0.09
Cl	0.06	Not analyzed	0.05	0.03	0.02	0.05
F	2.74	3.18	2.85	3.43	2.92	3.50

As the table shows, the carbonate contents of the Asiatic phosphorites is higher than that of the Moroccan phosphorites, causing a different behavior with respect to the time of reaction with sulfuric acid.

From a chemical point of view, the phosphorus in the phosphorite is combined in the form of fluoro-apatite (microcrystals disseminated in the mass of carbonates, silicates, sulfates, etc.).

As far as the physical and structural characteristics of the natural phosphates are concerned, one of the most important ones is the total specific surface area, which essentially distinguishes the phosphorites from the apatite concentrates.

This characteristic represents an important factor for the sulbility and reactivity of the natural phosphates with organic

and inorganic acids, determining in most cases the installation system in the case of plants established near the important deposits and leading, in the case of the phosphorites, to important simplifications in the technological process.

The total specific surface area varies between 11.9 square meters per gram for the Florida phosphorites and 21.8 square meters per gram for the North African ones (Gafsa) compared to 1.2 square meters per gram representing the total specific surface area of apatite.

The same considerations are also valid for the Asiatic phosphorites--a fact which was demonstrated in practice through the higher decomposition yield from the phosphorites (76 to 80 percent) than from apatite (73 to 74 percent), yields achieved in the discontinuous installation of the "Karl Marx" Chemical Combine.

The quantity of sulfuric acid theoretically required for the transformation of Asiatic phosphorites into superphosphate was calculated from the chemical composition of the phosphorite on the basis of the following reactions:

$$10\ Ca_5F(PO_4)_3 + 35\ H_2SO_4 \longrightarrow 15\ Ca(H_2PO_4)_2 + 35\ CaSO_4 + 10\ HF$$

(1) $$Ca_3(PO_4)_2 + 2H_2SO_4 \longrightarrow Ca(H_2PO_4)_2 + 2\ CaSO_4$$

(2) $$CaCO_3 + H_2SO_4 \longrightarrow CaSO_4 + CO_3 + H_2O$$

(3) $$CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + 2\ HF$$

(4) $$R_2O_3 + 3\ H_2SO_4 \longrightarrow R_2(SO_4)_3 + 3\ H_2O$$

(5) $$Na_2O + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O$$

(6) $$CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$$

According to the composition of the phosphorite (Table I) and the stoichiometric reactions, the quantity of H_2SO_4 M.H. [not identified] required for 100 grams of phosphorite will be:

For P_2O_5	$27.10 \times 1.38 =$	37.39 g H_2SO_4 M.H.
CO_2	$10.00 \times 2.23 =$	22.30 g H_2SO_4 M.H.
F	$3.18 \times 2.58 =$	8.20 g H_2SO_4 M.H.
R_2O_3	$0.27 \times 2.65 =$	0.75 g H_2SO_4 M.H.
Na_2O	$3.12 \times 1.58 =$	4.92 g H_2SO_4 M.H.
CaO (free)	$0.37 \times 1.78 =$	0.65 g H_2SO_4 M.H.
Total		74.21 g H_2SO_4 M.H.

The above calculations, as well as the chemical composition of the phosphorite, refer to an average sample taken from various lots with which the laboratory tests were made. In the plant, work was done with a phosphorite of similar composition, for which, through an analogous calculation, the theoretical ratio of grams of H_2SO_4 M.H. per 100 grams of phosphorite was established as 75.30.

The laboratory tests were carried out in glass vessels. The necessary amounts of sulfuric acid were heated to a fixed temperature, when agitation began, together with the introduction of the phosphorite in a uniform rhythm. The agitation lasted from 1.5 to 5 minutes. After agitation, the vessel and its contents were introduced into a stove, heated to a pre-established temperature, and held there for an hour for roasting.

In this manner changes were worked out according to different parameters. Thus:

1. Maintaining the temperature of the acid at 60 degrees centigrade, the duration of agitation at five minutes, and the roasting time at an hour at 85 degrees centigrade, the acid/phosphorite ratio varying between 74 and 82 percent of the theoretical one and the concentration of the acid increasing from 60 to 70 percent, the analyses carried out 24 hours after the preparation indicated an increase proportional to the acid concentration, the water-soluble P_2O_5 ranging from 10.9 to 13.4 percent, and P_2O_5 soluble in citrate varying between 9.2 and 12.5 percent.

It is emphasized that the soluble P_2O_5 concentration increases with the concentration of the acid up to a concentration of 68 percent. This is explainable by the fact that the humidity of the finished product decreases together with the increase in concentration.

2. Maintaining the concentration of the acid at 68 percent, the duration of agitation at 5 minutes, the roasting being done naturally without maintaining the temperature, and the acid/phosphorite ratio at 82 percent of the theoretical one and the temperature of the acid ranging from 50 to 70 degrees centigrade, the analysis of the resulting superphosphate 24 hours after the preparation indicated the percentage of P_2O_5 soluble in citrate to be 12.2 to 12.6 percent.

One may emphasize that increasing the temperature in the 50- to 70-degree centigrade interval does not bring about a noticeable variation in the contents of P_2O_5 soluble in citrate.

3. Maintaining the temperature of the acid at 60 degrees centigrade, the concentration of the acid at 68 percent, the duration of agitation at 5 minutes, the raosting being done with rapid cooling, and the acid/phosphorite ratio varying from 71 to 90 percent of the theoretical one, the analysis of the superphosphate 24 hours after its preparation shows a percentage of P_2O_5 soluble in citrate varying between 10.1 and 12.7 percent.

It may be emphasized that the optimum attacking ratio was between 80 and 82 percent of the theoretical one--i.e., 59 to 60 kilograms of H_2SO_4 M.H. per 100 kilograms of phosphorite.

4. Maintaining the temperature of the acid at 50 degrees centigrade, the concentration of the acid at 60 percent, the duration of agitation at 5 minutes, the roasting occurring for one hour at temperatures varying from 80 to 115 degrees centigrade, and the acid phosphorite ratio varying between 81 and 100 percent of the theoretical one, the analysis of the superphosphate within 48 hours after its preparation indicated a percentage of water-soluble P_2O_5 of 12.9 to 14.3 percent, the increase in the roasting temperature favoring this percentage.

5. Maintaining the temperature of the acid at 60 degrees centigrade, the concentration of the acid at 64 percent, the duration of agitation at 5 minutes, and the acid/phosphorite ratio at 83 percent of the theoretical one, the roasting being done for one hour at 95 to 100 degrees centigrade, and the aging time varying from one to 23 days, an analysis showed that the percentage of humidity falls from 16.10 per-

cent to 2.08 percent as the aging period increases and that the percentage of P_2O_5 (acidity) increases while the percentage of water-soluble P_2O_5 increases from 13.4 to 16.6 percent under the same conditions.

In conclusion, from the laboratory results the technological parameters were established for the preparation of superphosphate from phosphorites as follows: temperature of sulfuric acid, 60 degrees centigrade; concentration of sulfuric acid, 68 percent; grams of H_2SO_4 M.H. per 100 grams of phosphorites, 59 to 60; duration of agitation, 2 to 5 minutes; roasting time, one hour; roasting temperature, 90 to 100 degrees centigrade.

The following observations may also be added:

a) The influence of the temperature of the sulfuric acid is smaller than that of its concentration.

b) Mixing is important for the smooth unfolding of the reactions, but its prolongation does not contribute to an improvement in the finished product.

c) The acid/phosphorite ratio is of great importance: if the ratio is too small, the content of soluble P_2O_5 will be small, and if it is too large the superphosphate does not harden and the percentage of P_2O_5 does not increase either.

The elimination of humidity is of particular importance during the aging period; according to the data obtained, for each lowered percent of humidity there is a corresponding increase of 0.22 percent in soluble P_2O_5.

Starting with the results obtained in the laboratory, a transition was made to testing the manufacturing in industrial installations.

From the beginning, difficulties were encountered which determined the partial modification of the parameters established during the laboratory phase.

Owing to the reduced period during which the acid/phosphorite mixture remains in the mixer, the reaction continues strongly in the reaction wagonettes.

To moderate the reaction, the initial temperature of the acid was lowered to less than 50 degrees centigrade (40 to 45 degrees centigrade).

Owing to the specific nature of the installation, the period in the tunnel had to be lowered to 20 minutes from the one hour established in the laboratory (the roasting period).

For these reasons (temperature of the acid and duration of roasting) the temperature of the pulp when coming out from the mixer was 66 degrees centigrade, and that of the superphosphate during its stay in the tunnel reached a maximum of 80 degrees centigrade.

In order to reach a higher temperature (102 degrees centigrade), from the beginning of manufacturing to leaving the tunnel and unloading, the initial temperature of the acid had to be increased to 65 degrees centigrade.

In conclusion, the following technological parameters were established: temperature of sulfuric acid, 42 degrees centigrade; concentration of sulfuric acid, 68 percent; kilograms of H_2SO_4 M.H. per 100 kilograms of phosphorite ratio (R), 60; duration of agitation (time retained in the mixer), 45 seconds; roasting period, 20 minutes; roasting temperature, 75 to 80 degrees centigrade; acidity in the mixer, 30 to 33 percent.

With a number of experimental charges, the following results were obtained (Table II).

Table II

Number of Charge	P_2O_5 Total	P_2O_5 Soluble in Water	P_2O_5 Soluble in Citrate	P_2O_5 Acidity	H_2O	Decomposition Yield
		(in percent)				
1	15.3	11.4	12.1	5.1	19.9	79
2	15.7	11.0	11.9	6.0	22.0	76
3	15.6	11.8	12.5	6.0	23.6	80
4	17.8	12.8	13.6	2.9	18.5	76.5
Seven days after deposit						
5	-	12.0	13.0	3.1	20.5	-
6	-	12.4	13.2	4.1	21.2	-
7	-	12.8	13.7	3.6	20.5	-
8	-	12.0	13.0	3.4	19.7	-
9	-	12.3	13.2	3.2	17.9	-

[table continued]

10	-	13.0	14.0	3.9	19.8	-
11	-	12.9	13.8	3.0	18.9	-
12	-	12.4	13.1	3.4	19.1	-
13	-	12.0	13.0	2.8	19.7	-
14	-	12.8	14.0	3.3	22.1	-

Because of the low temperature and short roasting period, as well as the impossibility of carrying out the important operation of shoveling while the superphosphate remained in the aging depots, its humidity remains practically the same as at the beginning of the aging period. Because of the above reasons, a prolongation of the stay in the aging depot does not lower its humidity. A 50-percent decrease in this humidity would allow an increase of about 1.5 percent in the soluble P_2O_5 content.

In the course of manufacturing, even smaller results were obtained because of the imperfect dosage of raw materials, especially of phosphorite, which because of the variable humidity--storage being in the opan--did not lend itself to suitable dosage with the existing measuring equipment. (The necessity for the ever more constant preservation of the R ratio was shown in the laboratory studies.)

In order to verify the acid and phosphorite dosage in an attempt to obtain the optimal R ratio, control of the acidity in the mixer during manufacture was also introduced, the acidity having to be between 30 and 33 percent H_2SO_4.

In conclusion, the average chemical composition of the superphosphate produced from the phosphorites imported from the Asiatic Near East in the discontinuous installation of the "Karl Marx" Chemical Cambine is the following (in percent):

P_2O_5, total	17.0 to 18.0
P_2O_5, water-soluble	12.5 to 12.7
P_2O_5, soluble in citrate	13.5 to 13.6
P_2O_5, free acidity	3.4 to 2.9
H_2O, humidity	19.5 to 20.0

Under laboratory conditions, the humidity of the superphosphate fell to about 2 percent water and the acidity to 0.5 percent after 23 days. Applying these ideal conditions to

the superphosphate prepared in industrial installations might result in a free acidity of about 3 percent; the solubility in citrate might increase by one percent P_2O_5, and, as a result of lowering the humidity to 2 to 3 percent of water, an additional 3.5 percent could be added to the soluble P_2O_5. Consequently, there would result a superphosphate containing 18 percent of soluble P_2O_5.

These conditions, however, could not be achieved in practice under the regular manufacturing procedures, and even less so in the discontinuous installations, which do not have adequate equipment for airing, shoveling, storage, etc.

Undoubtedly results superior to those obtained in discontinuous operations could be obtained in installations with continuous manufacturing methods, such as the Moritz Standardt, as a result of improving the decomposition yield as well as because of the possibility of eliminating humidity during the aging of the superphosphate in suitable storage places.

According to the data obtained with reference to the behavior of the phosphorites during the decomposition reactions with sulfuric acid, we believe that the adaptation of rotating dryers into the manufacturing technology for superphosphate from phosphorites may yield satisfactory results.

Starting from the assumptions that:

a) the total specific surface area being 20 times as large as that of apatite, the reactivity of the phosphorites is even greater;
b) the high temperature during roasting accelerates the decomposition reactions;
c) the lowering of the humidity brings about an increase in the content of soluble P_2O_5;

and keeping in mind that in the actual manufacture of three-times granulated superphosphate this type of rotating dryer is used, its adaptation to the regular manufacturing process for the manufacture of superphosphate from phosphorites in the reaction between phosphoric acid and the phosphorites might give favorable conditions with the same equipment relating to the three important phases of roasting, aging, and granulating.

Since the aging is favored by lower temperatures, the optimal temperature being between 35 and 40 degrees centigrade, overheating in the final phase could be avoided through a study of the thermic balance in terms of the flow of material in a rotating dryer with steady current.

From the economic point of view, the utilization of natural phosphates with a low P_2O_5 content is not profitable for installations with discontinuous operation not possessing adequate auxiliary equipment.

We give a comparative situation (indices) of the cost of the superphosphate produced from phosphorite and from apatite concentrate during the first quarter of 1958 at the "Karl Marx" Chemical Combine.

If the utilities and fixed expenditures remain approximately constant, the difference is in the raw materials, which represent about 48 percent for the superphosphate from phosphorites as compared with 34 percent for the superphosphate from apatite, or an increase of 27 percent in the case of the phosphorites.

	Superphosphate from:	
	Phosphorite	Apatite
Sulfuric acid	104.4	100.0
Phosphatic concentrate	339.1	100.0
Utilities + fixed costs	105.2	100.0
Cost price, total	127.0	100.0

Conclusion

The processing of the phosphorites imported from the Asiatic Near East at the "Karl Marx" Chemical Combine is not profitable.

Owing to the inadequate equipment, the superphosphate obtained is of an inferior, Type II, or downgraded quality, which brings about a lower selling price, and the cost price of the superphosphate is higher than in the case of superphosphate produced from apatite concentrates.

RUMANIA

Manufacturing Simple Granulated Superphosphate and Sodium Fluosilicate at "Petru Poni" Chemical Fertilizer Works

[This is a translation of an article by M. Dumitrescu in Revista de Chimie, Vol X, No 5, May 1959, Bucharest, pages 288-290; CSO: 3380-N/g]

Until 1958 superphosphate was manufactured at "Petru Poni" Chemical Fertilizer Works in a discontinuous installation which assured a fairly high productive capacity.

When the new installation for the manufacture of superphosphate by the "Moritz Standardt" continuous procedure was put into operation in May 1958, the technological process was radically modified and adapted to the continuous process of manufacturing.

In the new installation, almost all manual labor was replaced with advanced mechanization. Similarly, measures were taken to assure the acquisition of apparatuses for the dosaging of raw materials and the entire installation was included in a system of blocks and signals.

In principle, the technological process proceeds as follows:

[1] The raw material--phosphatic ores, delivered to the plant in box cars--is distributed by automatic devices over the entire storage area. The manufacturing section is fed with the sorted materials.

[2] The phosphatic raw materials are dosed with an automatic scale.

[3] The raw material dosage with the automatic scale enters into the mixer through a "burla," where the phosphatic ore and the sulfuric acid are thoroughly mixed, yielding a fluid mixture which is continuously evacuated into the Moritz-Standardt superphosphate reactor.

[4] In the reactor, the superphosphate paste undergoes a hardening process which lasts from three to six hours.

[5] The superphosphate is transported through the rotation of the entire reactor into the cutting area of the carousel.

[6] The carousel is supplied at its periphery with shaving knives which cut the superphosphate as it revolves; it is then poured out and shipped to the superphosphate storage.

[7] The sulfuric acid required for the manufacturing is stored in two reservoirs, from which it is raised into the installation to a constant level in the tank with the aid of pumps.

[8] The acid which enters dilution is dosed with the aid of a rotating dosing device supplied with an adjustable level regulator.

[9] The water necessary for the dilution of the acid is distributed in an equal manner through the three dilution tanks with the aid of three dosing devices with membranes.

[10] The tanks for the dilution of the acid are supplied inside with cooling serpentines.

[11] From the last dilution tank the sulfuric acid goes through a constant-level tank to the rotating dosing device which feeds the mixer.

[12] The prepared superphosphate is put into storage.

[13] In storage, the warm superphosphate undergoes airing in order to assure a better mixing of the mass for the purpose of completing the reaction. These operations are carried out with the aid of two grab-buckets over a period of four to five days.

[14] The superphosphate prepared in this manner must be left in storage for a period of 20 to 25 days for aging; after this, the superphosphate is taken by grab-bucket to the chambers feeding a system of belts and elevators, and loaded directly into freight cars.

Quality of the Superphosphate

The quality of the product, evaluated in terms of its percentual content of assimilable P_2O_5, has varied very little in the past few years. Thus:

	1955	1956	1957	1958
Water-soluble P_2O_5	16.8	16.7	16.5	17.0

The minimal increase in the water-soluble P_2O_5 content from 16.5 to 17 percent is due to the imperfect mechanical system for the dosing and mixing of the raw materials.

A factor which determines the achievement of high quality superphosphate is the granulation of the raw material. The finer the grinding of the phosphates, the greater the total surface area of particles and thus the greater the reaction speed, the reaction taking place primarily on the surface of the particles.

The granulation of phosphorites from the Asiatic Near East gives 10 percent of waste on a sieve with 100 perforations per square centimeter and 68 percent of waste on a sieve with 1,600 perforations per square centimeter, as against 12 percent waste in a 1,600 perforation per square centimeter sieve in the case of apatite concentrate. For this reason, the superphosphate obtained from the first category is of poor quality and the decomposition yield is small.

For the decomposition process of the apatite to occur completely and at maximum speed, thereby assuring a suitable quality of superphosphate, the sulfuric acid has to be introduced at a concentration of 67 to 68 percent (in the continuous processes) and at a temperature of 55 to 60 degrees centigrade, or 50 to 55 degrees centigrade in the summer.

Other factors influencing the quality of the superphosphate are the duration and conditions of mixing. The parameters of the mechanical mixing system determine the degree of contact between the acid and the apatite, acting to obtain a thorough mixture of the ore and the acid, and are given by the rotation speed of the agitator or the peripheral speed respectively.

For this reason, the mixer with horizontal axles was replaced in November 1958 with a vertical mixer having four agitators with a peripheral speed of 5 meters per second and a retention time in the mixer of only 2 minutes. Since, however, the optimum mixing duration is considered to be 6 to 7 minutes, the rotation speed of the last two agitators will be modified and they will be put deeper into the mixer.

Finally, the maceration of the product influences the quality of the superphosphate. As was shown, the definitive decomposition of the phosphate and the elimination of the excess himidity takes place while it is deposited in the s storage area and aired. An acceleration of the decomposition is obtained by colling and pulverizing the superphosphate immediately after the evacuation as well as by covering it.

Technical-economic indices obtained (per ton of P_2O_5):

	1957	1958
MH Sulfuric Acid, kilograms	2,211	2,030
Apatite, kilograms	3,257	2,930
Electric power, kilowatt hours	55	49
Water, cubic meters	5	3

In 1957, a large part of the production was obtained from the Asiatic Near East phosphorites, whose high carbonate content leads to an increased consumption of sulfuric acid and a small P_2O_5 concentration (28 percent as agains 39 percent for apatite concentrates), which results in a low quality product with 13 to 14 percent of P_2O_5.

As far as possible, the consumption indices were checked separately with respect to thetypes of raw material in 1958.

The indices, however, are not conclusive because, although the installation is supplied with a scale for apatite, this nevertheless bogs down and does not function owing to the variation in the humidity of the material, which necessitates dosing with an improvised system which is not precise.

Production Difficulties

In case work has to be done with mixtures of phosphorites from the Asiatic Near East and Kola apatite concentrates, the mechanized installations for unloading the phosphates from freight cars must assure separate storing of the two raw materials. Owing to mechanical defects in the unloading devices, it sometimes happens that an uncontrolled mixture of these raw materials results and therefore the technological process cannot be observed and conducted for obtaining a maximum yield, because in the continuous installation the work must be done with sulfuric acid having a density of 1.53 to 1.54 at a temperature of 55 to 60 degrees centigrade for Kola apatite, and phosphorites with an acid density of 1.58 to 1.60 at a temperature of 35 to 40 degrees centigrade.

Because the manufacturing conditions are completely different, great difficulties arose with uncontrolled mixtures and considerable quantities of P_2O_5 were lost through the failure to achieve a maximum yield in transforming insoluble P_2O_5 into the soluble form.

For the dosing of the apatite, an automatic scale was introduced, which, however, did not give corrected results inasmuch as the humidity of the apatite arriving at the plant was 3 to 10 percent as against the 1 to 2 percent for which the respective scale was built. Under these conditions it became necessary to change to an improvised and imprecise dosing, which led to a product with great variations in quality and poor transformation yields.

For the dilution and dosing of the acid, a modification of the dilution system and of the acid feeding system was necessary in order to make possible an increased productive capacity compared to the original plan.

Similarly, the horizontal mixer assembled at the start of the section has not given corrected results even for a lower capacity. Under these conditions, a Soviet-built vertical mixer was installed with which it was possible to get a product with 18 to19 percent of P_2O_5 and 12 percent of free P_2O_5, at the evacuation from the reactor.

Another improvement to be achieved is the acceleration of construction work to increase the superphosphate storage

area in order to assure the normal aging time of the finished product.

Manufacture of Granulated Superphosphate

A modern installation for the granulation and ammoniation of superphosphate was assembled and placed into operation in 1958.

In contradistinction to other installations, granulation at the "Petru Poni" Chemical Fertilizer Works is carried out on a disk granulation system with possibilities for the ammoniation of the superphosphate up to a content of 2.5 percent nitrogen, or even higher if supplementary sulfuric acid is introduced on the granulating disk.

In this installation it is possible to granulate the superphosphate obtained from Kola apatite and Asiatic phosphorites (the proportion of raw materials being 3 to 1) immediately after it comes out of the reactor.

In principle, the technological process is as follows:

The crushed and ground superphosphate is passed for granulation onto the granulation disk, which rotates at 10 revolutions per minute.

To regulate the dimensions of the granules, the disks may be inclined according to need, the optimum inclination being, according to our technological tests, 47.5 to 48 degrees.

On the granulation disks, the superphosphate is sprinkled with a solution of sodium silicate in order to give it increased mechanical resistance, or it may be sprinkled only with water. If ammonia is used in the work, the superphosphate will also be sprinkled with a very small quantity of sulfuric acid.

The granules formed on the disks are poured onto the collar of the granulator, where they are powdered with phosphorite powder or with calcium carbonate in order to lower the free acidity and dry the granules. If ammoniation is included, the neutralization is done with ammonia.

The powdered or ammoniated granules are sifted, the usable grains (2 to 4 millimeters) being separated from the too fine and too coarse. The 2- to 4-millimeter granules are passed directly into storage, where they are aired with the aid of a rolling bridge in order to prevent agglomeration.

The waste composed of powder and fine and coarse granules is returned to the surface and falls on the inclined belt for the feeding of fresh superphosphate.

Factors Influencing the Granulation Process

The granulation on the disks occurs through a mechanical operation involving the rolling of superphosphate nuclei and taking advantage of the thixotropic properties of the granulated material. Owing to the mechanical action of the granulator, these nuclei will collect next to each other, forming an almost homogeneous substance.

The factors influencing the granulation capacity are:

1. The granular structure of the material. The material to be granulated has to be previously ground in order that the granulation process will be accomplished easily and that the percentage of small granules will be lowered as much as possible.

2. The mode of feeding the material and the sprinkling solution. The finer the feeding material, the more the sprinkling materials will have to be pulverized. The relationship between the material entering the granulator and the quantity of the sprinkling solution must be constant in order to preserve a constant granulation of the finished product which emerges from the granulation disk.

3. Dimensions of the granules. The variation of the dimensions of the granules may be made through the rotation speed of the disk, the height of the pouring collar, and the inclination of the granulator.

The granulators of the "Petru Poni" Chemical Fertilizer Works may only be regulated with respect to inclination and revolution--parameters which were followed in the course of the technological tests--with the following optimum conditions:

rotation, 10 revolutions per minute; inclination, 47.5 to 48 degrees.

Concentrations of Granulated Superphosphate Obtained at the "Petru Poni" Chemical Fertilizer Works

In the plant, granulation tests were made with macerated and fresh material as well as with superphosphate made from Kola apatite, phosphorites from the Near East, or a mixture of these. In all cases the installation was adequate, the only difficulty being that in the case of granulation with fresh materials the transport and dosing installations sink.

Inasmuch as most of the time calcium carbonate powder was used for neutralization and trying, the quality of the granulated superphosphate remained the same as that of the superphosphate entering the granulation installation, the percentage of assimilable P_2O_5 remaining within ± 0.5 percent as against the content of assimilable P_2O_5 in the ungranulated superphosphate.

The poor yields in the transformation of total P_2O_5 into assimilable P_2O_5 are due to the fact that the manufacturing installations operate without apparatuses for dosing the raw materials and that the mixing system is not yet in proper order.

Similarly, in the course of the tests the manufacturing section worked with nonconstant mixtures of Kola apatite and Near East phosphorites.

The recommended granulation yield (95 percent of granules between 2 and 5 millimeters) was not achieved because the section did not have at its disposal sieves with the prescribed dimensions (work was done with sieves fof 44 and 8 millimeters rather than 4 and 5 millimeters).

Ammoniation tests were carried out in the installation, and a granulated superphosphate with a nitrogen content of 1.6 to 2 percent was obtained.

Manufacture of Sodium Fluosilicate

Kola apatite contains approximately 2.5 to 2.7 percent fluorine in the form of calcium fluoride. At the time of attack on the apatite by sulfuric acid, the calcium fluoride also reacts, forming hydrofluoric acid, which reacts with the silocon dioxide contained in the apatite to form silicon tetrafluoride (gaseous state); this, through absorption in water, gives rise to fluosilicic acid, which, when treated with a solution of sodium fluoride, changes into sodium fluosilicate.

The absorption of the fluoridated gases and the obtaining of sodium fluosilicate at the "Petru Poni" Works occors in the following installation:

The gases drawn in from the mixer and the Moritz-Standardt reactor are led into two towers, where they are sprinkled with water in counter-current.

When entering, the gases have a concentration of about 10 to 15 grams per cubic meter. In the first absorption tower a 10 to 11 percent fluosilicic acid solution is obtained and then sent to the section for the processing of fluosilicate.

In the first tower it is sprinkled with a 2-percent solution which is obtained in the second (final) tower, and in the second tower it is sprinkled with pure water.

Rubber and bakelite were used as construction materials for the absorption apparatus (pipes of bakelite and towers lined with rubber). The 10 percent fluosilicic acid solution is continuously sent to two decantors where the silicon jelly is deposited. The solution passes without agitation into the precipitation reactor. In the reactor a 20-percent sodium chloride solution is introduced and it is agitated for about three minutes.

Since the reactor contains the silicon jelly, in addition to sodium hexachlorosilicate, they are separated by sedimentation, keeping in mind that the depositing speed of the silicon jelly is 10 times less than that of the fluosilicate. For this separation the reactor is supplied with three "stuturi" at different heights.

After the separation, the fluosilicate crystals go into a centriguge where they are washed with water, and then they proceed to the drying installation.

The drying takes place in a "snec" dryer with a steam-heated mantle. From the dryer, the fluosilicate, with a maximum humidity of 1 percent and 0.1 percent hydrochloric acid, goes to the packing section.

Since sodium fluosilicate is a toxic product for the humam organism, the entire apparatus for precipitation, drying, and packing is hermetically closed and efficiently ventilated.

Discussion

Improvements demanded in the course of the debates on several problems concerned such matters as incorporation of phosphatic fertilizers in GOST [not identified] (GOST provides 14 percent of soluble P_2O_5 for the phosphorites and we get 14.5 percent P_2O_5); concentration of the acid which is worked with (the largest P_2O_5 content was obtained with an 80- to 82-percent acid); mixing time; the reduction of specific concumption (especially by increasing the yield of transforming total P_2O_5 into P_2O_5, also taking the humidity into consideration; at the No 2 Chemical Combine, a transformation yield of up to 88 percent was achieved); the explanation of the fact that from Kola apatite we obtain a superphosphate with only 15.5 percent of P_2O_5 soluble in citrate (lack of aging, airing, increased humidity, etc.); conditions of processing imported phosphorites, etc.

1024

RUMANIA

Manufacture of Granulated Superphosphate at Navodari Superphosphate and Sulfuric Acid Plant

[This is a translation of an article by A. Vieru in Revista de Chimie, Vol X, No 5, May 1959, Bucharest, pages 290-292; CSO: 3380-N/h]

The USAS construction began in 1956 on the basis of Soviet plans, with key equipment brought from the USSR, and on 15 February 1959 technological tests began.

The unit built is the largest one in the country from the point of view of productive capacity and is equipped with mechanical and automatic devices placing it on a level of high technical complexity.

The manufacturing technological process for superphosphate occurs in a reactor similar to the one at the "Petru Poni" Works, differing only with respect to the granulation operation.

The granulation operation consists of the following main phases: the neutralized superphosphate is brought from storage to an intermediate shed by a conveyor, and from there it is brought by a belt feeder to a shed to be fed into the granulator. Water is brought into the granulator for wetting. The humid granules obtained in the granulator are taken for drying into the drying room.

The drying is done with gases from the burners, obtained by burning fuel oil.

The gases from the burners are mixed with air in the mixing chambers at 500 degrees centigrade and, passing through the drying drum, they are made free of dust in a cyclone, washed with water in a tower, and evacuated into the atmosphere with the aid of a ventilator. The dried granules enter into the drying drum through an unloading room, and with the aid of an elevator they are then brought to a vibrating sieve.

The product is separated on the sieve, according to the size of the granules, into three portions: granules under 1.0 millimeter; granules from 1.0 to 4 millimeters; granules above 4 millimeters.

Granules larger than 4 millimeters are "concasare" [not identified] and then are added through flowing funnels and elevators to the material exiting from the drying drum.

The granules smaller than one millimeter are brought by "snec" to the shed for loading into the granulator.

The granules with dimensions between 1.0 and 4 millimeters, which is the final product, are brought into the packing sheds with the aid of a conveyor. From there they are taken to the shed above the scale by rruck, and then into a semi-automatic scale.

The weighed amount is packaged in Kraft-type paper bags. The bags are sewed by sewing machine and are distributed to the storage areas by automatic loaders. The packaging material is brought to the storage area on a monorail.

Mechanization and Automation of the Production Process

The superphosphate plant is equipped with a series of devices forming part of the framework of technological control and automation of the production process and consisting of automatic regulators with indirect action, electric technological signaling, and electric blocking and remote control systems.

The operating section of the superphosphate plant represents the most important part of the whole technological cycle, and the productivity of the entire plant, as well as the quality of the finished product, depend on its functioning.

In the operating section the continuous processing of the apatite concentrate with sulfuric acid takes place. Following the reaction, superphosphate and hydrofluoric gases are obtained. The former is sent to the storage area for final processing, and the latter is absorbed in the form of fluosilicic acid in the fluosilicate section.

The main factors determining the technological process for the decomposition of the apatite concentrate and the quality and quantity of the final product are a stable and continuous concentration and temperature of the sulfuric acid used for mixing with apatite concentrate; a stable and continuous maintenance of the prescribed weight proportions between the quantities of apatite concentrate and dilute sulfuric acid; the quality of the mixture of dilute acid and the quality of the mixture of apatite concentrate with acid in the mixer.

These conditions are fulfilled as follows:

a) The automatic maintenance of the prescribed concentration of the sulfuric acid used for mixing with apatite concentrate.

The sulfuric acid as well as the water drop into the mixer under constant pressure from the respective reservoirs. After dilution, the acid enters into the concentration measuring device. The concentration measuring device operates by means of a continuous comparison of the specific weights with that of a sample acid of a known concentration similar to the one required in the technological process.

The results of the gravimentric comparisons are registered by differential manometers in the form of pressure drops in the piezometric tube. The pressure drop characterizing the value of the reduction (specific weight of the acid to be controlled as against the sample acid) is transformed by the differential manometer into a corresponding electrical impulse, which is transmitted to the concentration regulator.

In the regulator, the electrical impulse obtained from the differential manometer is amplified and transformed into a pneumatic control impulse, which acts on the membrane of a valve mounted on the pipe for feeding water to the mixer.

Thus each change in the concentration is accombanied by a corresponding modification of the quantity of water to be used for dilution.

b) The automatic maintenance of the prescribed weight proportions between the apatite concentrate and the sulfuric acid to be mixed.

The quantity of concentrate is dosed by weight with a gravimetric belt dosing device.

The weight of acid corresponding to the quantity of apatite is maintained automatically by a volume regulator as follows: the dilute sulfuric acid enters through a volume meter with a "fante" [pressure valve?]; the pressures passing through the "fante", characterizing the instantaneous increases in the acid volume (in weight units), are registered by a differential manometer in the form of pressure and are transformed into electrical impulses which are transmitted to the volume regulator; in the regulator the electrical impulses are amplified and transformed into pneumatic control impulses, which are transmitted to the regulating valves mounted on the acid pipe before the mixer.

c) The automatic regulation of the temperature.

The automatic maintenance of the prescribed temperature of the mass passing from the mixer into the chamber is a determining factor for the productivity and the quality of the finished product.

Variations in temperature may occur for the following reasons: the reaction temperature during the mixing of the raw materials; the temperature and quantity of the raw materials brought to the mixer; heat losses to the surrounding atmosphere. The last two factors depend on meteorological conditions and cannot be regulated, although they may be taken into consideration in establishing the technological conditions, especially since these variations, though large, occur slowly in terms of time. The first factor is the only one which influences the technological temperature conditions--namely, the temperature of the dilute acid. The temperature of the dilute acid is regulated as follows: in the high reservoir for the acid, a serpentine is mounted through which steam passes; the temperature of the acid is measured after it is diluted with a resistance thermometer; the pneumatic control impulse is transmitted from the regulator to a valve regulating the variable quantity of steam brought in for heating the acid.

d) Controlling the temperature.

In addition to automatic regulation of the sulfuric acid temperature, independent temperature controls are also

provided for the acid in the high reservoir, the water in the high reservoir, the acid in the flow meter, and the mass in the mixer.

The mechanisms and automatic devices for the continuous action superphosphate chamber may be divided into a series of aggregates in accordance with their use and the character of the functions they fulfill--namely:

a) mechanisms for transportation of the apatite concentrates from storage to the chamber;
b) mechanisms and devices for the preparation and dosing of sulfuric acid and apatite concentrate;
c) mechanism for mixing the reactants and for unloading the mass in the chamber;
d) mechanisms for the chamber proper and the carousel;
e) mechanisms for transporting the superphosphate from storage and spreading it.

Mechanisms of the aggregates a), d), and e) are mechanisms with individual electric activating devices; the mechanisms of aggregates b) and c), because of lighter control needs, are combined into a unitary control, signaling, and blocking system.

In this system are incorporated the mixer for the apatite and acid; the gravimetric dosing device for the apatite; the quantity and concentration regulator of the sulfuric acid, as well as the temperature regulator; signal devices for the water and acid levels in the high reservoirs; a signal for the presence of the apatite concentrate in the dosing scale shed, and the signal for the presence of air in the main compressed air pipe.

The technological signaling elements comprise indicator signaling, notification signaling, and shortage signaling.

The first category includes the luminous signals which are automatically connected for filling the shed for the apatite dosing device; connection of the motor activating the apatite dosing device; connection of all agitators of the mixer; functioning of the chamber; functioning of the carousel; functioning of the conveyor under the chamber; regulation of the quantity and concentration of the acid entering the mixer; manual regulation of the above parameters; position of the valve regulating the supply of steam for heating the acid.

The category of notification signals includes devices which alert the personnel when one of the parameters or critical values has been reached, and intervention is necessary for the neutralization of the signals. In this sense, notification signaling occurs in the following cases: lowering of the apatite concentrate level in the isolating shed; lowering of the acid level in the high reservoir; lowering of the pressure in the compressed air pipe. The automatic notification signaling is both optical and acoustic.

The shortage signals always connect the activities of the installation to automatic blocking devices and are designed to indicate to the personnel the cause for the system's disconnection. This takes place in the following cases: lack of apatite concentrate on the dosing device belt; lowering of the water level in the high reservoir; lowering of the acid level in the high reservoir; closing of the regulation valve in the inflow acid pipe; lowering of the pressure in the main compressed air pipe.

The section for the granulation of the superphosphate also contains automatic control parameters and automatic signaling and blocking devices.

It is important for the technological process of granulating the superphosphate to maintain optimum humidification conditions for the neutralized superphosphate and the thermic drying conditions for the granulated superphosphate in the drying drum.

Because of the lack of a device for the permanent determination of the humidity of both the initial and humidified superphosphate, the problem was solved indirectly. The humidity necessary for the granulation of the superphosphate is maintained by establishing the quantities of superphosphate and water entering the granulator. The superphosphate is dosed with the aid of a feeder, and the water with the aid of roto-meters.

Measures for Improving Technology

Even though it might be premature to make concrete appraisals of future improvements in the production process,

yet we may show what has been done for the adaptation of advanced techniques parallel with investments and in relationship with future prospects for the plant.

In the existing installations for raw superphosphate, it is possible to process and obtain only one third of the granulated superphosphate required by our agriculture.

If instead of a granulator with the existing drum, four-disk granulators were installed which could use the product directly from the reaction chamber circuit, a quantity of superphosphate double the present one could be granulated annually. This is the level which will finally be reached with the current installation for raw superphosphate on the basis of modifications to be made in the mechanized feeding and transport installations.

In relation to what has been shown, the new granulating section is to be placed into operation in 1960, on which occasion the superphosphate plant with increased capacity will be able to deliver all granulated superphosphate [needed].

This modification, with minimal investments, will lead to a lowering of costs for granulated superphosphate by 20 lei per ton.

In addition, the current granulation installation may be used, together with a part of its equipment, for new types designed for increasing the profitability of the plant.

With a view to increasing the capacity for the production of raw superphosphate in connection with enlarging the granulation section, the plant has a plan for installing a second reactor, which will be assembled on the site of the present mechanical shop and incorporated into the feeding and transportation circuit of the present storage space. This increase in the productive capacity will make it possible to triple the annual superphosphate production.

1024

RUMANIA

Circulation of Fertilizers from Producer to Consumer

[This is a translation of an article by V. Urseanu in Revista de Chimie, Vol X, No 5, May 1959, Bucharest, pages 292-293; CSO: 3380-N/i]

Owing to the ever-increasing quantities of mineral fertilizers which will be produced in our country in the near future as a consequence of the demands of agriculture, the problem of their circulation from producer to consumer will have to be solved as soon as possible under optimal technological-economic conditions.

In this sense, the following are treated:

1. The present system of supply and marketing.
2. The present situation with regard to packaging and transportation
3. The present situation with regard to the storage and preservation of fertilizers until the time of use.

The analysis of the cirrent situation viewed from the point of view of the above parameters reveals a series of difficulties, deficiencies, and shortcomings with the respective consequences on agriculture and with the conclusion that the increase in the quantities of mineral fertilizers circulating between producer and consumer will accentuate these deficiences.

The analysis of the difficulties, deficiencies, and shortcomings makes it possible to establish the causes and thus eliminate them. In this sense the following is observed and proposed:

1. Fertilizer consumers are divided into too many groups (five) employing different forms, organs, and procedures of supply; it is proposed to reduce the number of consumer groups to a maximum of four.

2. The creation of a single national enterprise besides Centrocoop [Central Union of Consumer Cooperatives] is considered opportune; it should concern itself with the contract-

ing of all technical plants, which is now done by nine different institutions having separate organizational apparatuses, and another enterprise should be created with the task of supplying the cooperative and individual sector of agriculture with fertilizers, especially for technical crops under contract, as the present system of distribution with the preparation of the list of recipients and the very large number of contracts with the producing plants often causes delays in supply.

3. To establish the necessary mineral fertilizers and to prevent waste through unsuitable application, it is necessary that the consuming units be given a minimum of technical instruction and guidance indices.

4. The distribution of the types of fertilizers in terms of users and in terms of producing plants should be coordinated in time and done by the Department of Agriculture in collaboration with Centrocoop and the Ministry of Petroleum and Chemical Industry, establishing a simplified procedure to be elaborated under joint agreement.

5. A series of difficulties in the fertilizer situation have arisen from the variable quality of the fertilizers as well as in the fact that in most cases they were delivered in powdered form and in bulk. To eliminate these difficulties it is proposed that the Ministry of Petroleum and Chemical Industry take measures to enforce the quality conditions, to supply increasingly more granulation of the fertilizers, and to deliver them in suitable packages.

6. In order to prevent delay in the arrival of the fertilizers to the consumption points--currently a quite frequent phenomenon, especially in the season--it is recommended that the Ministry of Petroleum and Chemical Industry, together with the Ministry of Transportation and the Department of Agriculture, elaborate an agreement for the regulation of the problems relating to deliveries.

7. To regulate the transportation of fertilizers from the railway stations to the raion storage areas or to the consuming units, it is necessary that the necessary large stock of machines be established for the destination stations in terms of the freight car arrival schedule.

8. The fact that the production of fertilizers is continuous while the consumption is only during a certain season of

the year will make the problem of storage very important as production increases. It is observed that currently fertilizers are in many cases unloaded directly onto the ground, with the following effects: the superphosphate absorbs moisture, especially if it has an excess of acidity, and thus becomes plastic and adherent; a single rainfall would causes losses of up to 20 to 30 percent of the uncovered fertilizers; the ammonium nitrate packaged in nonbituminated bats agglomerates, and at the same time it has a corrosive effect on the paper, so that 40 to 50 percent of the bags break, with corresponding fertilizer losses.

9. A series of plans have been elaborated for the storage of fertilizers, and it is necessary to implement the optimal solution, especially in case permanent constructionsare found to be necessary. At the same time it is proposed to study the possibilities of obtaining a number of provisional storage areas for the storage of fertilizers in any existing space which remains periodically unused (examples: sheep sheds after the sheep have gone to pasture; equipment areas after the brigades have gone to the fields; some shelter areas under quarantine, etc.).

10. Considering the problem of storing fertilizers as a key problem in their circulation from the producer to the consumer, the following is proposed:

[a] To organize commissions in the regions composed of the organs of the Ministry of Agriculture and Silivicuiture together with the regional and raion organs, which would establish a network of permanent storage spaces to be established within the radius of each raion, taking into consideration the railway network, and especially the network of usable highways, with emphasis on the consumption needs of the units grouped near the railway stations; similarly, it should take into consideration the current possibilities for storaging in the machine-tractor stations or even at the consumer units--possibilities which should be exploited.

[b] The storage capacity of a permanent raion storage must represent one quarter of the needs of the agricultural sector it services or a three-month production of the delivering industry; this means that from 1 December to 1 March the storage areas will be filled; on 1 March, the emptying begins for spring consumption, and the quantities being delivered in March, April, and May will be sent directly to the consumption areas without storage; on 1 June the storage areas

will be empty, and the amounts which will be delivered during June, July, and August will be deposited in such a way that by 1 September the storage areas will be full and it will be possible to begin emptying them for the fall campaign; the amounts delivered during September, October, and November will no longer be stored but will be guided directly toward the consumption areas, so that by 1 December the storage areas will be completely empty.

1024

RUMANIA

Mechanized Application of Fertilizers and Plant Treatment

[This is a translation of an article by T. Dragos in Revista de Chimie, Vol X, No 5, May 1959, Bucharest, pages 293-295; CSO: 3380-N/j]

Knowing the advantages of mechanizing the operations relating to the administration of chemical fertilizers, the Research Institute for the Mechanization and Electrification of Agriculture--the ICMEA--of Bucharest is studying various methods and machines in terms of the time required for the application of fertilizers with a view to introducing into production as soon as possible the most rational and economical machines and methods most urgently needed.

With respect to the problem of mechanizing the application of mineral fertilizers before sowing--i.e., basic fertilization--all types of spreaders and all brands of machines imported for the purpose were tested. Of these we may mention spreaders with chains, rollers, disks, and caterpillars, and the TR-1, STK-2.5 types of Soviet construction; Gendy of American construction; D-333 and TS-55 of East German construction; Amazona of West German construction; and Novitan and Agrostroj of Czechoslovak construction.

The agrotechnical requirements to be met, which formed the basis for establishing the type of spreader and machine for the conditions in Rumania, were the following:

1. The uniformity of spreading ferilizers on the soil and incorporating them into the soil should be 90 ± 10 percent for a maximum wind intensity of two meters per second on terrains with slopes of up to 12 degrees.

2. It should be possible to spread or incorporate all types of chemical fertilizers, regardless of form--powder, crystals, or granules--with a maximum humidity of 15 percent and particle dimensions of not over 7 millimeters.

3. It should distribute variable quantities per hectare as required, from 50 to 600 kilograms for chemical fertilizers and up to 2,400 kilograms for "amelioratives," during a single

operation with the same machine, the quantities being regulatable in 25-kilogram steps for norms up to 600 kilograms and in 50-kilogram steps for norms larger than 600 kilograms for the same type of fertilizer.

4. The displacement speed while working should be at least 4 kilometers per hour regardless of the preparation of the soil, and on favorable terrain it should reach a maximum of 10 kilometers per hour.

The results obtained with the types of spreaders mentioned above were as follows:

[a] For ammonium nitrate, the distribution uniformity at a wind speed of 0.5 meters per second was 99 percent with the caterpillar spreaders, 86 percent with the disk spreaders, 83 percent with the roller spreaders, and 78 percent with the chain spreaders at a fertilizer humidity of 7.2 percent and on horizontal terrain.

[b] For potassium salts, the uniformity of distribution was 97 percent with disk spreaders, 75 percent with caterpillar spreaders, and 25 percent with chain spreaders, while roller spreaders could not be used as they cannot apply these fertilizers. The humidity of the fertilizer was 8.7 percent, with the speed and the slope of the terrain as above.

[c] For superphosphate and thermophosphate, the uniformity of distribution was 97 percent with disk spreaders, 92 percent with caterpillar spreaders, 91 percent with chain spreaders, and 90 percent with roller spreaders. The humidity of the fertilizer was 5.6 percent and the wind speed and slope of the terrain was the same as above.

From this it follows that for the same slope, wind, humidity, and fertilizer quality conditions, the only type of spreader which completely satisfied the requirements for all types of fertilizers is the disk spreader. The other types, such as the roller ones, are not suitable because if the fertilizer has a humidity of more than 7 percent it will penetrate into the rollers and a complete cylinder will thus be formed which can no longer deliver the fertilizer properly to the rhomboidal orifices at the bottom of the box, while in the box itself lumps will be formed and the spreaders will no longer be capable of distributing the fertilizer.

Good results can be obtained with this spreader only when the fertilizer is very dry, in powdered form or granulated, and of uniform particle size.

In the case of caterpillar spreaders, the same phenomenon was observed as with the roller spreader--i.e., it become coated with fertilizer and becomes a complete cylinder revolving in an empty space without carrying along any fertilizer; and in the case of the chain distributor lumps are formed in the fertilizer mass so that it becomes impossible for it to carry along the fertilizer properly when it has a humidity of over 7 percent.

In tests made with disk spreaders, it was observed that a uniformity of 90 $\pm$ 10 percent is preserved up to a humidity of 15 percent, and above this limit they distribute fertilizer with a uniformity within the admissible limit of 70 $\pm$ 20 percent considered acceptable for difficult working conditions, while the other types of spreaders can no longer distribute at humidities higher than 15 percent within the uniformity limits acceptable for such conditions.

This fact has led to the recommendation for the use of machines equipped with disk spreaders.

Besides the fertilizer distribution qualities, the disk machines have a higher operational safety coefficient--0.95 in comparison with the other types, whose safety coefficients are 10 to 15 percent lower.

Keeping the above facts in view, beginning with the second quarter of 1957 our agriculture was equipped with disk-type mechanical traction machines designated as MIT-3.6 manufactured at the "Victoria" Plants of Bucharest, and at present there are over 3,000 such machines in production.

The productivity of the aggregate is 2 to 3.2 hectares per hour. The quantities of fertilizer which it can distribute per hectare are between 50 and 600 kilograms, and the quantities of amelioratives between 600 and 2,400 kilograms.

When it is necessary to apply amelioratives on certain soils in quantities larger than 2,400 kilograms per hectare, it is necessary to go over the same area two or three times with the machine.

* * *

In addition to introducing into production these machines for servicing horizontal terrains within the framework of the state sector, the ICMEA [Research Institute for the Mechanization and Electrification of Agriculture] in 1958 also finished and duplicated the construction of a machine with animal traction for the application of chemical fertilizers to service the cooperative sector and sloping terrains within the state sector. This machine is designated as MIT-2.5 and has the same operating principle as the MIT-3.6 machine with mechanical traction, the only difference being that instead of the traction triangle it has a device for one or two horses and its working width is 2.5 meters instead of 3.6. Both the quality of the work and the other working conditions are similar to those of the MIT-3.6 machine--aside from the productivity, which has a value of 0.8 to 0.9 hectares per hour.

* * *

Also for basic fertilization of the soil by spreading chemical fertilizers, two machines submitted as proposed innovations are currently being tested, both with a disk-type distribution system, one being pulled by the UTOS-26 tractor and the other being pulled on wheels with tires, and with working widths of 5.3 meters and a possibility of changing the position of the fertilizer box in the case of machine transportation, thus reducing the width of the clearance gauge by 55 percent.

*** *

With respect to the second category of operations--namely, the fertilization of the soil simultaneously with sowing--all types of spreaders and all brands of domestic or imported machines designed for the application of fertilizers concurrently with sowing or planting were tested.

Thus experiments were carried out with the SON-2.8 legume sowers, McCormick grain sowers, SZT-47 grass and grain sowers, McCormick sowers for spreading plants, SKG-4 and SKGK-4A machines for potato planting, McCormick pasture regenerators, and other machines with devices suitable for the application of fertilizers.

The tests showed that for the application of chemical fertilizers together with the sowing of spreading plants and especially corn, the most suitable device is one of the rotating disk type. This consists of a cylindrical box, on the bottom of which there is a rotating disk which carries the fertilizer in the form of powder, crystals, or granules into the tubes directing the fertilizer to the plows, which bury it in the soil in continuous or interrupted rows to the desired depth.

The distribution norms can be regulated between 40 and 950 kilograms per hectare in terms of the rotations of the disk, which can be adjusted from 10.40 to 47.20 revolutions per minute by a change in the transmission relationship between the motor wheels and the sower and the rotating disk.

The uniformity of application for granulated or powdered chemical fertilizers, with a humidity of up to 15 percent, was between 80 and 94 percent for superphosphate, 85 to 96 percent for nitrolime, 85 to 98 percent for powdered and granulated ammonium nitrate, and 80 to 92 percent for potassium salts. These data show that the application of fertilizers with this type of spreader corresponds to the agrotechnical requirements.

It was observed that if the fertilizer has a humidity above 15 percent the spreader does not work.

Fertilizers in powdered form cannot be administred satisfactorily with this type of spreader unless their humidity is below 7 percent.

Taking into account the need to fertilize the soil concomitantly with the sowing, especially in raising corn, with a view to obtaining harvests greater than the average production of 4,000 kilograms per hectare, the 2-SPC-2 type of corn sower was also equipped with this type of spreader, agriculture having so far been supplied with over 4,000 such units.

* * *

With respect to the application of chemical fertilizers concurrently with the sowing of grain, it was observed that, on the basis of our experiments, not one type of spreader

distributed the fertilizers in either powdered, crystalline, or granulated form, in conformity with agrotechnical requirements at a humidity higher than 7 percent.

* * *

On the problem of mechanizing the application of chemical fertilizer during the vegetation period, and especially in the case of spreading plants (in the case of cereals, the same machines are used as for basic fertilization of the soil), different types of cultivators with suitable devices for fertilizer application were tested.

The best results were obtained with the AT-2 device, which operates on the principle of leading the fertilizer from the box, by means of two disks and a plate, into the metallic tube leading to the plows, which bury the fertilizer in the soil at depth adjustable to 16 centimeters.

The per hectare fertilizer norms can be regulated from 52 kilograms to 620 kilograms in 15-kilogram steps, in terms of the relationship between the transmission and the position of the graduated section of the partition between the disks.

The distribution uniformity is between 83 and 92 percent. for granulated fertilizers with a humidity under 15 percent, and 70 to 81 percent for crystallized or powdered fertilizers with a humidity under 7 percent for all types of fertilizers.

In order to test the possibility of applying chemical fertilizers now in production while fertilizing corn, the AT-2 devices were adapted to the cultivators carried by GPU-1.2, manufactured in Rumania. They could be used only to a small extent during supplementary feeding, since the fertilizer could not be administered because it changed to lumps and bogged down the moving parts when the humidity was higher than 7 percent in the case of powders or crystals or 15 percent in the case of granules.

* * *

In addition to the problem of administering chemical fertilizers, a particularly difficult problem for agricultural

units is that of preparing fertilizers, which involves the following operations:

a) mixing the various chemical fertilizers or mixing chemical fertilizers with organic ones;
b) granulating organic-chemical fertilizer mixtures;
c) crushing the solid chemical fertilizers agglomerated into large lumps;
d) sifting the fertilizers before feeding them into the machines.

As a result of the studies and experiments carried out by the ICMEA in this respect, the following conclusions were reached:

[a] The operations relating to mixing chemical fertilizers and mixing chemical fertilizers with organic ones, as well as the granulation of organic-chemical mixtures, are not large-scale operations at the present stage and thus do not require the construction of mechanized means at this stage.

[b] The operations of crushing and sifting agglomerated fertilizers have first priority in the needed mechanization.

With respect to the second problem, the possibility of carrying out these operations with the existing machines was studied; thus the following were tested: the DKU-1.2 hammer-mill, the BMP-9 combine for flailing corn, the TR-4 crusher, and the Tudor Vladimirescu grain combine. Taking into consideration the condition of the fertilizer before it is crumbled as well as the requirements it must fulfill after being crumbled, the best results were obtained in practice with the Tudor Vladimirescu combine. The results were as follows:

[1] The Tudor Vladimirescu combine, powered by the UTOS-26 tractor with a drum speed of 900 to 1,000 revolutions per minute, crushes ammonium nitrate agglomerated in lumps of up to 40 kilograms.

[2] The productivity of the combine in crushing fertilizers is 54 tons per day, with a working time coefficient of 0.7; 95 percent of the fertilizer crumbled has granule dimensions under 7 millimeters.

* * *

Aside from the above, particular importance is attached to the problem of applying liquid or gaseous chemical fertilizers, especially nitrogenous ones--a problem which is in the research stage in most countries.

In our country the question of using anhydrous ammonia for fertilizing the soil was raised for the first time by the Ministry of Petroleum and Chemical Industry when it submitted for study an innovation proposal relating to the construction of a device for the incorporation of anhydrous ammonia mounted on the CUT-21 cultivator and the IAR-511 sower. Simultaneously, the effects of the application of anhydrous ammonia and of ammonia solution are being studied.

* * *

Another fertilizing procedure used in modern technology is the application of bacterial fertilizers. The application is made by mixing the seeds prior to sowing with the bacteria prepared in the form of powder or gelatin (agar-agar). These bacterial operations can be carried out with the fertilizer either humid or dry. For the mechanization of these operations, the hand-operated pulverizer and the mechanically powered MTS-1 machine for treating seeds may be used successfully in our country.

As far as the problem of modifying the pH of the soil is concerned, this may be achieved chemically by the application of amelioratives (lime or gypsum).

The application of amelioratives is mechanized by using machines similar to those used for spreading chemical fertilizers. Very often the machines for spreading chemical fertilizers are also used for spreading amelioratives.

For the mechanized application of amelioratives, the MI-52 machine and the MIT-3.6 and MIT-2.5 machines for spreading chemical fertilizers are used in our country, and centrifugal machines are being studied.

* * *

In addition to the problem of mechanizing the operations relating to the application of chemical fertilizers, a particularly important problem is that of treating agricultural and horti-viticultural cultivations with chemical substances for combating pests, cryptogamic diseases, and weeds.

For this purpose the ICMEA tested the imported types of machines used in the field and in horti-viticultural cultivation: the S-082 portable machine, the S-511 tractor-drawn machine, and the S-612, imported from East Germany; the Lachosette machines for spraying and dusting vineyards and the Pall-Vermorel injector from France; the Champion machines for treating with herbicides from the USA; the Rapidtox machine for spraying and wet dusting of orchards from Hungary; the Agrostroj machine for spraying in legumiculture from Czechoslovakia; the Lands-Bulldog machine, on a self-propelled chassis, for spraying low cultivations, from West Germany; and all types of machines designed for this purpose, including a machine for digging trap ditches to combat pests in sugar beet cultivation.

On the basis of the tests made on these machines, it was possible to select machines for phyto-sanitary treatment in Rumanian agriculture--a system which was also adopted and introduced in the international system.

Beginning in 1957, the ICMEA, together with the machine-building plants, began to apply the system of machines established and put the following machines into production: machine for spraying and dusting as well as applying herbicides on field cultivations powered by the UTOS-26 tractor, portable pumps, and hand-operated aggregates for spraying and dusting. On the basis of the models tested by the ICMEA and approved by the Interdepartmental Commission for the Protection of Plants, machines for spraying and dusting--both with animal traction--of vineyards planted at distances of 1.0 to 1.5 meters apart, a combined machine for spraying and dustring drawn by tractor for vineyards planted at distances of 1.5 to 2.0 meters, a combined tractor-drawn machine for spraying and dusting in orchards, and a combined spraying-dusting machine with animal traction for field cultivations are all in the course of being perfected.

These machines are supplied with a device for mechanical feeding of solutions and pulverization of the solution into small particles between 50 and 500 microns for all cultivations except orchards, where pulverization into particles of up to

1,000 microns may be achieved. The uniformity of distribution of the solutions is within the admissible limits, with values between 90 and 97 percent, and dusting within 75 and 80 percent at wind speeds of up to 1.5 meters per second on terrains with a slope of up to 6 degrees. The distance between the nozzles and the plants may be adjusted from 0.30 meters to 1.0 meter for all cultivations, and in orchards it reaches 15 to 20 meters. The nozzles are fan-shaped and have an adjustable cone which makes it possible to regulate the jet of pulverized solution as desired in terms of the crop being treated.

At present, the various installations for aerosol products are being tested and an installation for the determination of the dimensions of the particles of pulverized solutions is being built at ICMEA. In order to establish the work indices and the functional and constructional characteristics of the machine, the efficiency of treatment with various chemical substances with various dimensions of the pulverized particles is being studied in collaboration with ICAR [Rumanian Institute of Agronomic Research] and ICHV [not identified].

These were, in brief, the results obtained with the means of mechanization required for the application of chemical fertilizers and plant protection treatments used in agriculture.

Discussion

The problem of crushing ammonium nitrate is explained (the existing machines are used: the hammermill, for which the fertilizer must undergo prior crushing for a granulation of about 10 millimeters; and the combine, which can also crush large lumps), as well as the problem of the corrosive action on the moving parts and the problem of the existence of other properties of fertilizers which may influence the behavior of the machines (a study is now in progress to determine the characteristics which the chemical products must have to be usable in all machines).

- END -

1024